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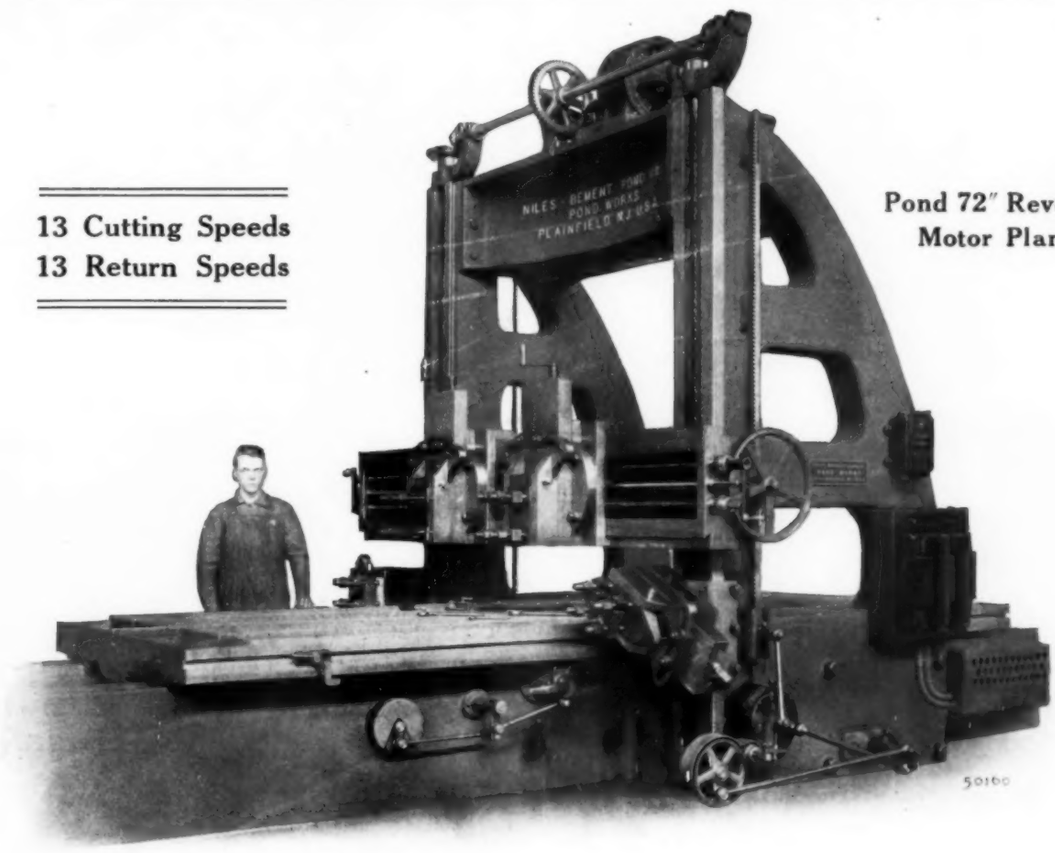
Pond Reversing Motor Planer

With Pond Patent Planer Control

13 Cutting Speeds
13 Return Speeds



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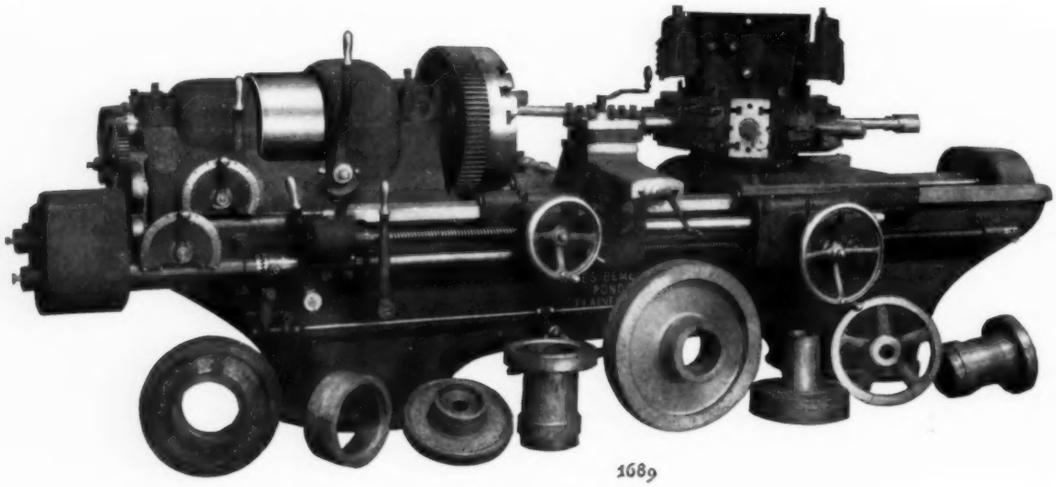

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Chucking Bevels for Grinding

By E. A. Suverkrop*

Various methods of chucking hardened bevel gears for grinding. The gears are held on the pitch line by a chuck having two rings of flexibly held balls. These methods have been developed by and are used in the shops of the Brown-Lipe-Chapin Gear Company, Syracuse, New York.

*Associate editor.

No problem has troubled the grinding room more than the chucking of bevel gears and pinions. These troubles have been overcome in the shops of the Brown-Lipe-Chapin Gear Company, in the following manner: At *A*, Fig. 1, is shown a hardened-steel bevel gear 12 inches diameter 6 inches in the hole. This is to be ground on the inside and also on the back as shown at *D*, Fig. 2. The chuck *B*, Figs. 1 and 2 is itself made from a hardened gear. The method of making would probably be of interest: A soft gear was first secured to the faceplate so that it ran perfectly true. A hardened gear was then selected, care being used to get one which had warped very slightly or not at all in the hardening. This hard gear was then placed on the soft gear faceplate as shown by the gear *A*, Fig. 2, gear *B*, Fig. 2, representing the soft gear. It was lightly but firmly held in mesh with *B* by the flat springs *C*, Fig. 2, and was then ground true in the hole and where it was to be secured to the faceplate. This done, the soft gear was replaced by the hardened gear *B*, Figs. 1 and 2. With this rig about 175 gears can be chucked and ground in ten hours.

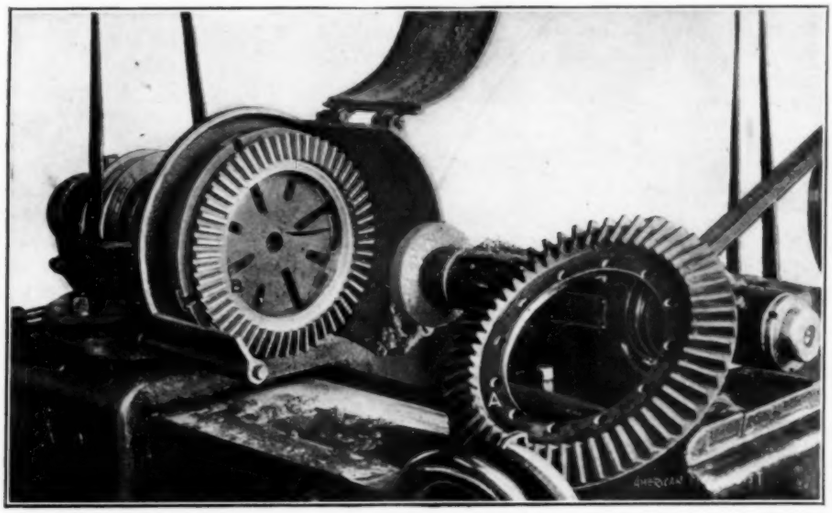


FIG. 1. THE GEAR IN THE CHUCK

CHUCKING HARDENED PINIONS FOR GRINDING

Fig. 3 shows a chuck in use in the grinding shop for holding hardened bevel pinions by the pitch line. It consists primarily of two rings of flexibly held balls, the inner ring of balls of such size as to suit the small end of the pinion and the outer ring having larger balls to conform to the larger size of the teeth spaces at the large end of the pinion. Each ring is provided with the same number of balls as the pinion has teeth. The inner ring of balls is mounted in a sleeve slideably mounted in the spindle of the head, but provided with a strong spring which normally forces it toward the outer ring of balls. The member *A* is threaded internally to fit the external thread on the body of the chuck and is provided with a rim similar to a handwheel rim for screwing it on and off the body. Just inside the rim is a rectangular recess *D* in depth equal to the depth of the opening *C* and in width a loose fit for the lugs *E* of the spider *B* which in use it accommodates. The openings *C* are a little wider than the lugs *E* of the spider.

Fig. 4 shows a pinion in the chuck but with the spider removed for clearness. At *B*, Fig. 4, is shown the back of the spider hub which bears on the large end of the pinion.

Chucking is accomplished as follows: The pinion is inserted as shown in Fig. 4. The spider is then entered in the openings *C* and given a slight turn in the rectangular recess *D*. The rim *A* is then turned right hand, which forces the hub of the spider against the large end of the pinion. The balls in the rear ring, which are forced forward, as previously stated, by a spring, have found a bearing on the pitch line of the teeth near the small end of the pinion. As *A* is turned the small ring at the rear is forced back against the pressure of the spring and when finally the balls in the rigid front ring come to a seat on the teeth near the large end of the pinion it is ready for the grinder to finish the hole.

In this manner the pinion is held by the two rings of flexibly held balls *near* each end of it. Any warping or irregularities in individual teeth are averaged up in the whole pinion, giving far better results than are obtained by any method which relies on but a few, say three, contact points for centering.

In Fig. 5 is shown the head in section but not the spring on the inside sleeve *C*. At *A* is the seat for the inner ball ring and at *B* for the outer or rigid ball ring. The ball rings are as shown in Fig. 6. The internal flange *C* has spaces cut in it like

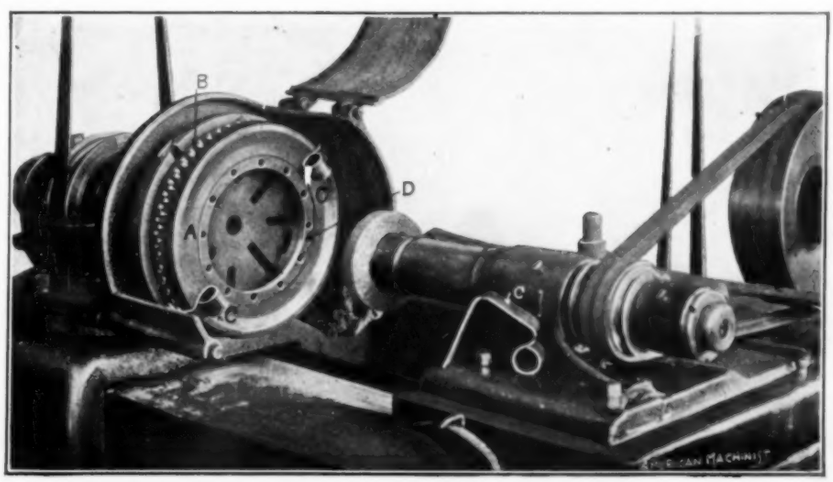


FIG. 2. THE CHUCK AND THE GEAR

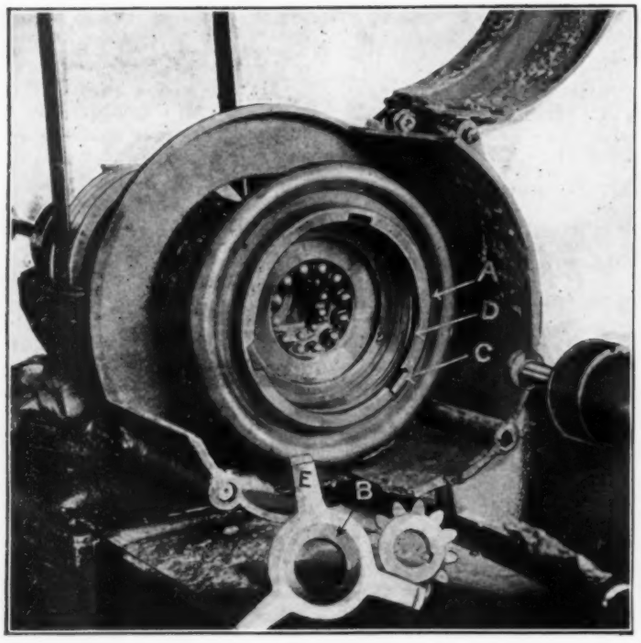


FIG. 3. THE BALL CHUCK OPEN, USED FOR HARDENED BEVEL PINIONS BY THE PITCH LINE

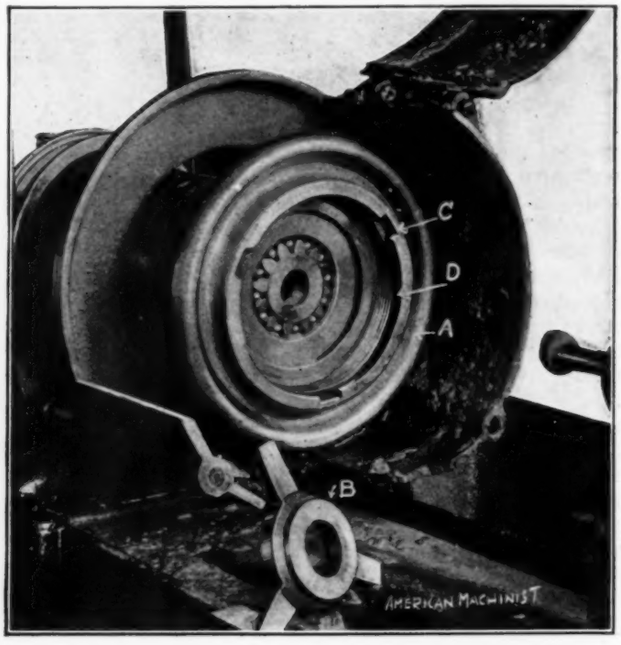


FIG. 4. PINION IN PLACE IN THE BALL CHUCK WITH SPIDER REMOVED FOR CLEARNESS

B but these spaces are wider than the teeth of the pinion at the pitch line so that they will not prevent the teeth seating on the ball. They may, however, act as drivers. The balls are held by rivets which are tight in the balls but loose in the ring. They have heads to prevent them from falling out. The rivets thus placed allow the balls to float and center the pinion. When the pinion is in grinding position the balls *A* bear on the internal and diagonal flanges of the rings as well as on the pitch line of the teeth of the gear being ground.

By referring to Fig. 5 it will be noted that the spindle is hung on the ball bearings *D* and *E*, being driven by the pulley *F*. This construction has been found to be very satisfactory. Other heads made with cylindrical and conical bearings were all cut to pieces by the grit and did not last any length of time. With this rig an operator can grind the holes in 200 pinions in 10 hours.

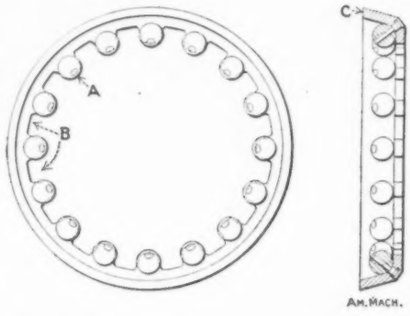


FIG. 6. THE BALL RING IN THE CHUCK

CHUCKING HARDENED BEVEL PINIONS BY THE FACE OF THE TEETH

Fig. 7 shows a simple chuck for holding hardened pinions for grinding. It was formerly used for grinding the holes in hardened-steel crosses for automobiles in evidence of which note the semi-circular grooves *B* and the semi-circular hooks on the holding springs *A*. It was bored to the face angle of the pinions, which are placed in it as shown. The faces of the teeth seat in the chuck. The pinions are lightly but firmly held by the springs *A* which are readily turned out of the way for the removal of the finished pinion. With this method of chucking insertion and removal of the work is accomplished with ease and is so rapid that 300 pinions can be ground in 10 hours in one machine.

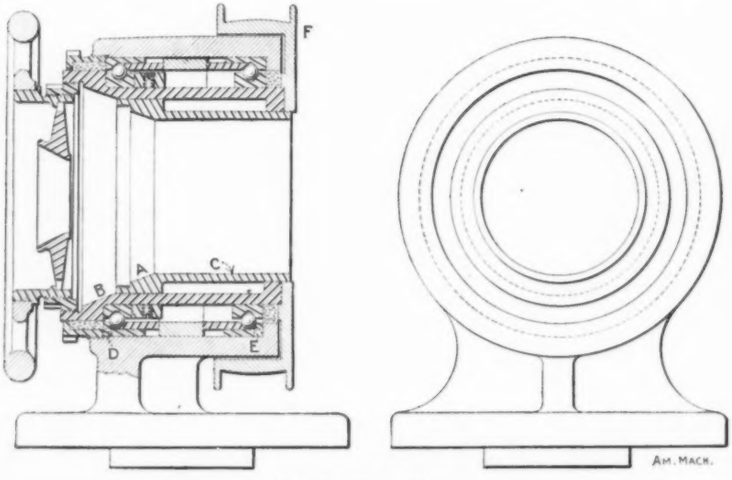


FIG. 5. THE HEAD

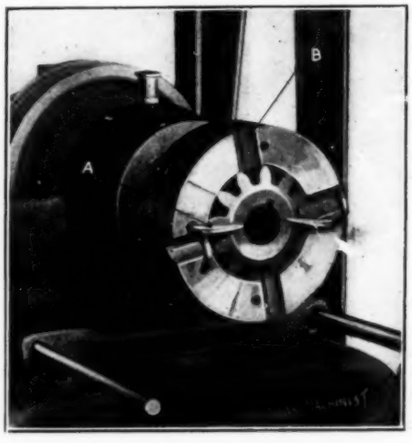


FIG. 7. CHUCKING PINIONS BY THE TEETH FACES

A Tool Room Index for Laying Off Angles

By C. A. Guion*

Devices for laying off angles in the tool room seem to be very much to the fore in the American Machinist just now, and this leads me to send two illustrations of a fixture which we have found so successful that four of them have been made for our model and tool-making departments.

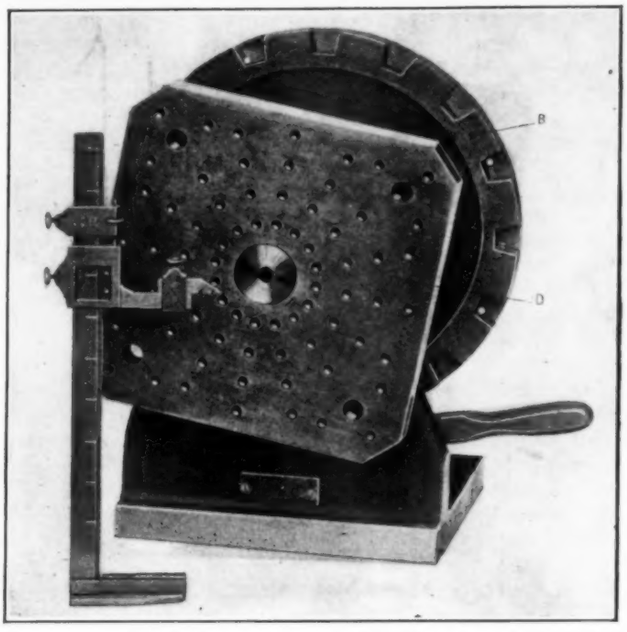
A graduated circle *A* and a notched indexed plate *B* serve to obtain the required angle. The ring *A* is attached to the plate *B*, which latter is a fairly snug fit on the spindle. Attached to the spindle are the adjusting plate *C* and the faceplate *D*, the latter having a series of holes for attaching the work to it. An index pointer *E* is fastened to the base, and a latch lever *F* carries a block for engaging the notches in the notched plate.

The spindle has a standard-sized hole through it, the center of which is exactly 7½ inches from the base. A hight gage with vernier attachment enables the work to be located initially exactly horizontal, and, if need be, exactly central with the plate.

For those angles for which they will suffice, the adjustments are made directly from the notched plate. For smaller angles the graduated circle and adjusting plate *C* are used, an index pointer *G* on the latter traversing the graduations on the former. Plate *C* may be clamped to the notched plate *B* by means of the capstan-headed screws shown, and when these are loosened it may be adjusted for the angle by means of the adjusting screw *H*.

The notched plate and the graduated circle may be used in combination when necessary. The notches give angles of 22½ degrees directly, and if we need an angle of say 30 degrees we first move the work one notch of the notched plate and then get the remaining 7½ degrees by means of the adjusting plate, which has a range of about 40 degrees.

Instrument makers will supply graduated circles of a degree of precision equal to anything made in the machine shop, and with such a circle and a glass for reading it, such a tool as the one shown may obviously be made to give results of the highest degree of accuracy. In our own case the circles were made at home by means of the index head of a universal miller, and they have been found sufficiently accurate for all the work which we have had occasion to make.



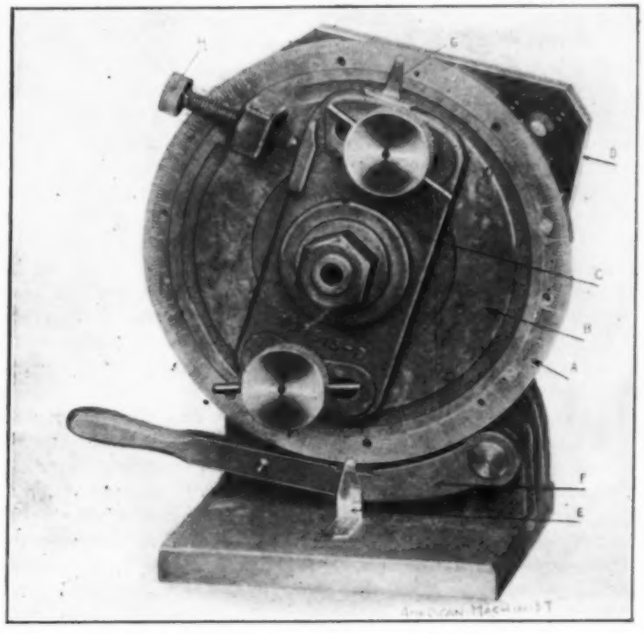


Fig. 1 A Tool-room Index Head for Laying Off Angles Fig. 2

*Foreman, model-making department, National Cash Register Company, Dayton, Ohio.

Fixture for Testing Adding Machine Springs

By David Melville

The fixture shown in the illustration is used for testing the various small springs on an adding machine and has a capacity up to six inches.

It is essential that these springs are all up to test, as much depends on them in the working of the machine.

Each style spring has a different symbol number, of which there is a table giving this number and also the length and weight at which the spring is to be tested. These springs are tested from a master spring, which is tested, previously to using, by weighing.

The fixture is set at a length given in the table, and the weight at which this master spring is tested is suspended from one of the arms, the master spring being hooked up to the opposite arm. The master spring being up to test, the weight is removed, and the stock springs are compared to it.

The fixture is clamped to the bench with four wood screws. *A* is riveted to the base by two ¼-inch projections, which have been formed with a hollow mill.

The arm *B* swivels on 60-degree centers. The center in the front of the fixture is a drive fit, while the opposite one is screwed in place and locked with a nut.

The indicator *C* is made of 1/32-inch spring steel and riveted to *B*. Arm *E* is free to slide on the graduated scale and is locked with the thumb nut *F*; *B* and *E* are drilled in each end to receive the small hooks shown, which are made from spring wire; they are made a good fit and soft soldered in place. A sectional view of *B* and *E* is shown in Fig. 2.

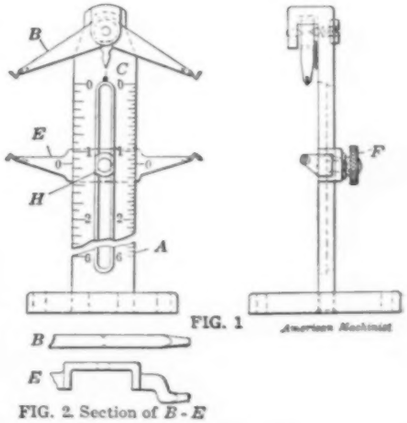


FIG. 1

FIG. 2. Section of *B-E*

Fixture for Testing Adding-machine Springs

Output Under Scientific Management

By Holden A. Evans *

Some common shop conditions, not conducive to maximum output, that have been greatly benefited by a broad application of scientific management principles.

*Naval constructor, United States Navy.

The important benefits, both to employer and employee, obtained by the use of scientific methods in industrial work are attracting much attention. In considering these benefits, many assume that the high output per worker is due entirely to the incentive provided in the method of payment employed. They overlook the fact that the payment scheme, whereby the worker obtains a bonus for a standard output is but one of several elements of good management, all of which are essential if maximum output and low production costs are to be obtained.

The results secured by means of scientific management, which attract attention are as follows:

The large daily output of each worker. This is two to four times as great as ordinarily obtained in a shop working under the day-work system; it is two to four times as great as what is generally termed a "fair day's work."

The high wages earned by employees, under this system, as compared with the usual day-work wages.

The cordial relations which exist between employer and employee.

The fact that comparisons are usually made between the output of a worker who is paid under the bonus system and a worker paid under the day-work system, leads many to believe that the larger output of the bonus worker is due entirely to his extra efforts. These believe that the credit for the additional output belongs to the worker, and that the management has little or no part in the achievement of this result. Not a few fear that the "speeding up," as they call it, is not only injurious to the worker, but may, in time, injure our national life. I have been surprised to find that these views are held by some sound business men who have read recent newspaper and magazine articles on scientific management.

These do not know that in many cases output may be largely increased without increasing one iota the efforts of the worker; they do not realize that they are comparing the output of a worker employed in a shop managed in accordance with scientific principles with that of a worker employed in a shop where scientific methods are unknown; they have entirely overlooked the fact that the management is largely responsible for the increased output.

Industrial inefficiency with consequent low output and high production cost is, aside from the inefficiency of labor, due principally to the following named conditions:

Poor tools. This may be due to poor material, improper treatment or incorrectly shaped tools, or a combination of these defects.

Insufficient supply of small tools or a poor tool-supply system.

Poor condition of belts.

Poor condition of machine tools and appliances.

No system for routing work; and the work not planned ahead.

Wasted time due to waits for information or material.

It is evident to any manager or engineer that the defects enumerated reduce output, and if remedied the output can be materially increased without additional efforts on the part of the workmen. It seems strange that any manager will allow defects like these to exist; it does not require much investigation to bring them to light, and once known they must be remedied. Yet, in many plants every defect enumerated exists; they are found in practically every shop operated under the day-work system. This is true in spite of the fact that able managers are in charge of these establishments.

Owners and managers do not believe that these conditions exist in their plants. Defects cannot be remedied until known, and if managers are ignorant of their existence, there is little chance of a remedy being effected.

Even when the defects are known, and are one by one corrected, it is very difficult to *keep* them corrected. It will require constant watchfulness on the part of the supervisory force to prevent backsliding; if there is any let-up in the watchfulness of the bosses a return to the old conditions is inevitable. In the usual day-work shop it is almost impossible to keep these defects eliminated; it is extremely difficult to maintain standards; there is no barometer which will indicate in an unmistakable manner the lowering of the standards, or the return to former unsatisfactory conditions.

A comparison of these conditions, which are typical of the day-work shop, with the conditions which exist in the shop managed in accordance with scientific principles, is of interest.

An essential element of scientific management is an efficient rate-making department. This is necessary whether it is for the purpose of fixing standard times for the bonus system, or for fixing the high and low rates of the differential piece-rate system. In both cases the rates must be accurate.

Harrington Emerson once asked Mr. Gantt what happened in case one of the workmen, whose time he had set managed to do the task in less than the time prescribed. Mr. Gantt replied that in that case the workman would take his place and he would take the workman's place. This emphasizes the importance that Mr. Gantt attaches to rate setting, and also emphasizes the accuracy which is possible.

In fixing rates the maximum that can be done by a first-class man when following instructions must be determined. This is an impossibility unless the man making the rate knows the condition of the machines, tools, belts and equipment; and this condition must always be the same, that is, standard. The rate maker also cannot make allowance for waits for tools, material or information, and if there are waits, the rates set will not be in proportion to the time taken to do the work.

Suppose that when the work is done any one of these conditions varies from the standard. It may be that the belt is poor and will not pull the cut specified, or the condition of the machine or tools may not be good, or there may be a wait for tools or necessary drawings. If any one of these conditions, which are so common in the usual day-work shop that they attract little attention, is encountered it is inevitable that the time taken to do the work will be greater than that allowed by the rate setter, and the workman will fail to earn a bonus.

One of the important rules of scientific management is that every loss of bonus or every failure to reach the high differential rate must be investigated and the cause determined. If it is due to defect in equipment the defect is remedied and the blame fixed; if it is due to inexperience or lack of ability on the part of the workman he must be instructed, he must be given every opportunity to learn to do the work in the standard time, and if finally he cannot, or will not, perform the task, he must be replaced by one who will. The workers must be protected; if they fail to earn a bonus through faults of others, these conditions must be immediately corrected.

With scientific methods the blame for failure to earn a bonus can be readily fixed. The required operations are given and are minutely described in writing by the planning department, and the time required for each operation is stated. If the rate-making department has set an impossible task, this can readily be dem-

onstrated; the burden of proof is on the rate maker; he must prove by actual demonstration that the task can be accomplished in the time allowed.

If the cause of the failure to earn a bonus is due to a bad belt, poor tools, or poor material, or to waits for any cause, the blame can be fixed. With functional management and standardization the responsibility for operation and every function is definitely determined. These conditions automatically maintain the standards which have been established.

The bonus cannot be earned unless the standards are maintained, and therefore each worker is interested in seeing that they are maintained. If he fails to earn his bonus through the faults of others he will immediately report the cause and will assist in removing it. The bonus of the gang bosses and the foremen is based on the number of bonus workers under them; every failure to earn a bonus reduces the bonus of the gang bosses and the foremen. There is, therefore, cordial coöperation between the workmen and the supervising force to maintain the standards in order that there may be the greatest possible number of bonus workers.

The management, also, in investigating every failure to earn a bonus, obtains immediate knowledge of any dereliction on the part of workmen or supervising forces.

Under this system there will be no waits, the machine tools maintained in excellent condition, the belts always good, the tools properly made and ground, and the many things which are often considered small and receive but little attention, but which have an important bearing on the efficiency of the shop, are in this shop automatically maintained in excellent condition.

These physical conditions, and the cooperation of the workmen and the supervising force are largely responsible for the large output obtained under scientific management. It is far from the truth to assume that the increased output is due entirely to extra physical efforts of the workmen. No doubt in the majority of cases there is extra physical effort by the workman, but this is only one element among many which are responsible for the large increase in output. Any fear that a workman under this system of management may injure himself by too much work is groundless. If this were true, the system could not rightfully be called scientific management; the foundation would not be stable.

One of the important aims of scientific management is to keep the workman in good physical condition, and make him contented and happy. Unless the management does its part in securing these ends, the coöperation of the workmen cannot be secured, and without this the best results cannot be obtained.

A Driving Wheel Tire Mandrel

Most of our readers have seen, and many have used, the form of mandrel having an angle cut on one side, with a roller in this cut, by which the work is gripped to the mandrel, but few, we imagine, have seen mandrels made on this principle of sufficient size for use in turning locomotive driving-wheel tires.

FIG. 1. A DRIVING-WHEEL TIRE MANDREL

Such a mandrel is shown in Figs. 1 and 2, which are from the Collinwood shops of the Lake Shore & Michigan Southern Railway, where the construction is in regular use.

Fig. 1 is almost self-explanatory, so far as general construction is concerned, the rollers and angle grooves being plainly shown. At the top of the mandrel is an additional slot for a use, which is very important, but which might be easily overlooked in laying out such a mandrel. Its use is to provide a place for the chain sling by which the tire is suspended from the crane when being placed in position on the mandrel.

Fig. 2 is from a working drawing and gives full particulars for making the mandrel. This construction is used at the Collinwood shops for a great variety of sizes from those suitable for driving-wheel tires down.

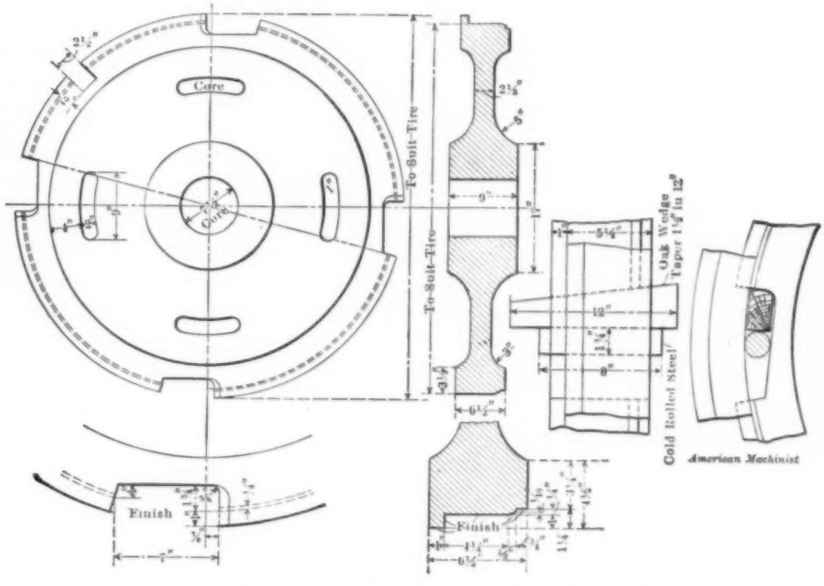


FIG. 2. DETAILS OF DRIVING-WHEEL TIRE MANDREL

Cobalt-Chromium vs. Steel

The recent successful production of cobalt-chromium alloys, and the value of these alloys for small cutting tools, is described in the annual report of Arthur D. Little, Inc., of Boston, as official chemists to the American Brass Founders Association.

The hardening effect of chromium when added to steel is well known, and it is only recently that it became known that it produced the same effect when added to metals other than iron. An alloy of 75 per cent. cobalt and 25 per cent. chromium is tough and malleable and can be hammered into thin sheets at bright red heat without cracking. Its most important property is its extreme resistance to corrosion. In commenting on this alloy the inventor states that he believes that the alloy of cobalt and chromium is the only non-ferrous alloy that combines the cutting qualities of steel with the non-tarnishing qualities of gold and platinum, that can be made in sufficient quantity and at a price that will permit of its general use for small cutlery. In this connection, however, it should be noted that an alloy of chromium and nickel has been patented which is claimed to possess similar properties to the cobalt-chromium alloy. Razors and table knives have been made from it with success, although its principal application appears to have been as a bearing metal.

The results so far obtained promise a wide field for chromium.

Construction of Locomotive Frames

The report of the committee of the American Railway Master Mechanics' Association on the construction of locomotive frames makes some interesting suggestions and gives a few rules.

Cast steel, made to a rational specification, careful foundry manipulation, adequate and suitable annealing, was spoken of as one of the remedies for frame breakages at that time, and it still is the favorite material, if properly designed, made and annealed.

The clip binder was then, and is now, more used than probably any other type, the bolt and thimble style having been discarded in modern practice, owing to stretch of bolts.

The specifications suggested by the Committee of Steel-Casting Manufacturers, and submitted to the Association in 1904, are as follows:

Material: Acid open-hearth steel, 0.28 carbon, 0.05 phosphorus, 0.05 sulphur, 0.60 manganese.

Frames will be rejected that show: Less than 0.20 or over 0.35 carbon; over 0.06 phosphorus; over 0.06 sulphur; over 0.70 manganese.

Tensile strength per square inch, not less than 55,000 pounds.

Elongation in 2 inches, not less than 15 per cent.

All frames to be annealed by heating uniformly to 1560 degrees Fahrenheit.

It is recommended in cross bracing, that ties be fastened full length of pedestal jaw, vertically on rear pedestal, of each driving wheel, or as close an equivalent to this design as governing conditions will permit.

The thickness of bosses on cast-steel cross-tie braces are to be not less than 1½, preferably 2 times, diameter of bolt used in fastening.

All bolts, where possible, to have heads next to castings, to insure full bearing on bolt.

Diameter of bolt at thread = nearest ⅛-inch to $\frac{\text{Width of frame}}{4}$.

Where size of bolts comes in even sixteenths, the smaller diameter will be used.

Body of bolt to be 1/16 inch larger.

Rules for Proportioning Locomotive Frames

A careful investigation of this matter shows that the stresses locomotive frames are subjected to are very complex, and that it is impossible to fully analyze them in an entirely satisfactory manner. The methods of proportioning, therefore, consist in using a low-fiber stress, derived from the known forces, which gives relatively higher factors of safety than are customary in the design of simpler and more easily calculated structures.

If the stresses in locomotive frames were produced only by the internal force of the engine itself, for example, as in the case of a stationary engine, without reference to movement on the track, the problem would be a comparatively simple one. It is altogether probable, then, that the fiber stress of the frames under these conditions could be so accurately predetermined that no breakages would occur, if at all reasonable skill and forethought were exercised in their design.

Stationary-engine Considerations

The simple proposition for the stationary engine is complicated for the locomotive by the conditions under which it is operated. It has to run on all sorts and conditions of tracks, involving frequent great variations in horizontal and vertical alinement, excessive curvature, irregularities due to frogs, switches, etc. The stresses are influenced very materially by the speed at which the locomotive may run, both on straight and curved portions, involving vertical and lateral movements, the first usually due to irregularities of the track and the second to the centrifugal forces in rounding curves or to the swaying and lurching of the engine.

Because of the complex nature of the stresses, it is therefore impossible to satisfactorily account for all of them, and it is necessary to make the factor of safety, derived from the known stresses, correspondingly high in order to take care of the unknown stresses.

In building locomotives, it is customary to proportion frames in terms of the cylinder thrust; that is, the area of one cylinder in square inches multiplied by the boiler pressure. The resulting figure is taken for the basis, and this divided by certain constants for different portions of the frame produces frame sections proportional to the size and power of the locomotive.

Because of the simplicity and the ease with which proportions like these can be obtained, and on account of the extremely large unknown stress which cannot be satisfactorily accounted for, the difference caused by the center of cylinders and the centers of frames are not usually considered. Assuming cylinder and frame centers of 86 and 46 inches, respectively, then these figures would be increased 60 per cent. by taking into account the increased movements derived from the local dimensions given, but the increase is disregarded because it is nearly proportional in all engines and taken care of in the low constants.

Sections for Bar Frames

The following approximate rules will produce sections for bar frames, either in wrought iron or cast steel, suitable for modern locomotives:

$$A = \frac{T}{2500 \text{ to } 2700}, \quad B = \frac{T}{3000 \text{ to } 3200},$$

$$C = \frac{T}{4300 \text{ to } 4500}, \quad D = \frac{T}{1600 \text{ to } 1800}.$$

multiplied by boiler pressure).

T = Piston thrust (area of cylinder multiplied by boiler pressure).

A = Square inches of sectional area of frame, top of pedestals.

B = Square inches of sectional area of frame, top rail between pedestals.

C = Square inches of sectional area of frame, lower rail between pedestals.

D = Square inches of sectional area of frame, integral single rail at back cylinder-keying lug.

As most of the frame bolts are vertical it is advisable to make the width greater than the depth to allow for the material cut away by the bolt holes. This is now being done in many cases, the frames occasionally reading 6 inches in width, which gives a bolt 1½ inches at the thread.

Forty-five Degree Spiral Gearing

By E. J. Kearney*

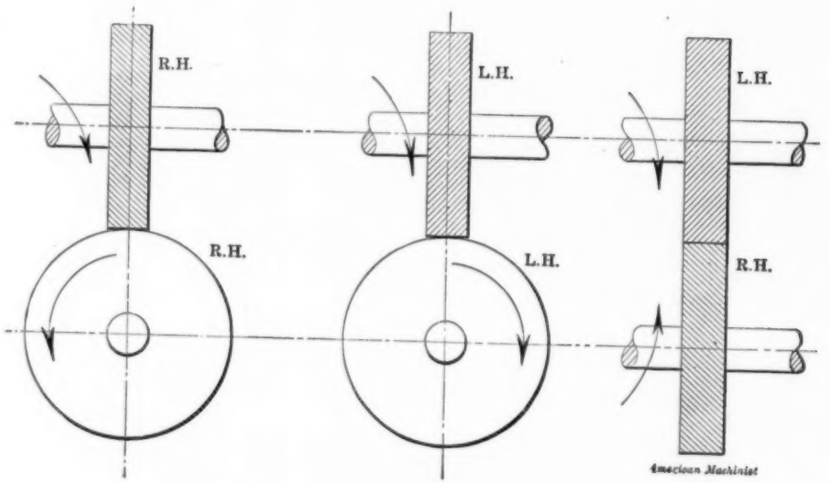
Numerous articles which have been published in the American Machinist are a witness to the fact that the subject of spiral gearing when treated broadly is a complex one. Most of the complexities disappear, however, when the gears have a tooth angle of 45 degrees, and it is perhaps for this reason that a large percentage—certainly 75, and possibly 90 per cent.—of spiral gears are made with this angle.

Such gears need not, however, be apologized for. Quite otherwise, in fact, for this is very nearly the most favorable angle for durability, and, except in cases when higher speed ratios than can be obtained from a single pair of 45-degree gears have to be dealt with, there is seldom any good reason for using any other angle. Such gears are the simplest of all to lay out and to make, the required speed ratios being obtained by varying the diameters, precisely as with spur gears, the rules for the speed ratio being the same in both cases. Moreover, the various factors required in laying out and making such gears can be reduced to a simple table.

Herewith I offer such a table which I have worked out, and by which anyone can quickly make the few calculations connected with any pair of 45-degree gears having teeth between 2 and 48 diametral pitch.

*The Kearney & Trecker Company, Milwaukee, Wis.

Pitch of Cutter	Pitch Diameter	Pitch of Spiral in Inches to One Turn	Number of Teeth in Spur Same Curvature	Outside Diameter	Thickness of Tooth at Pitch Line (Normal)	Depth of Tooth	Clearance	Circular Pitch (Normal)
	Mulitply by Number of Teeth in Spiral Gear			Add to P.D.				
2	0.70710	2.22142	2.828	1.0000	0.7854	1.0785	0.0785	1.5708
2½	0.62855	1.97464	2.828	0.8888	0.6981	0.9587	0.0699	1.3963
2½	0.56566	1.77707	2.828	0.8000	0.6283	0.8628	0.0628	1.2566
2¾	0.51425	1.61556	2.828	0.7273	0.5712	0.7844	0.0572	1.1424
3	0.47140	1.48094	2.828	0.6666	0.5236	0.7190	0.0524	1.0472
3½	0.40406	1.26939	2.828	0.5714	0.4488	0.6163	0.0449	0.8976
4	0.35355	1.11071	2.828	0.5000	0.3927	0.5393	0.0393	0.7854
5	0.28283	0.88853	2.828	0.4000	0.3142	0.4314	0.0314	0.6283
6	0.23570	0.74047	2.828	0.3333	0.2618	0.3595	0.0262	0.5236
7	0.20203	0.63469	2.828	0.2857	0.2244	0.3081	0.0224	0.4488
8	0.17677	0.55534	2.828	0.2500	0.1963	0.2696	0.0196	0.3927
9	0.15714	0.49367	2.828	0.2222	0.1745	0.2397	0.0175	0.3491
10	0.14143	0.44431	2.828	0.2000	0.1571	0.2157	0.0157	0.3142
11	0.12856	0.40388	2.828	0.1818	0.1428	0.1961	0.0143	0.2856
12	0.11785	0.37024	2.828	0.1666	0.1309	0.1798	0.0131	0.2618
14	0.10101	0.31733	2.828	0.1429	0.1122	0.1541	0.0112	0.2244
16	0.08836	0.27759	2.828	0.1250	0.0982	0.1348	0.0098	0.1963
18	0.07855	0.24677	2.828	0.1111	0.0873	0.1198	0.0088	0.1745
20	0.07071	0.22214	2.828	0.1000	0.0785	0.1079	0.0079	0.1571
22	0.06428	0.20194	2.828	0.0909	0.0714	0.0980	0.0071	0.1428
24	0.05892	0.18510	2.828	0.0833	0.0654	0.0898	0.0065	0.1309
26	0.05437	0.17081	2.828	0.0769	0.0604	0.0829	0.0060	0.1208
28	0.05050	0.15865	2.828	0.0714	0.0561	0.0770	0.0056	0.1122
30	0.04713	0.14806	2.828	0.0666	0.0524	0.0719	0.0053	0.1047
32	0.04425	0.13901	2.828	0.0625	0.0491	0.0674	0.0050	0.0982
36	0.03929	0.12343	2.828	0.0555	0.0436	0.0599	0.0043	0.0785
40	0.03533	0.11099	2.828	0.0500	0.0393	0.0539	0.0039	0.0873
48	0.02944	0.09249	2.828	0.0417	0.0327	0.0449	0.0033	0.0654



EXAMPLE.

Let it be desired to construct a pair of spiral gears with 35 teeth in the gear and 16 teeth in the pinion, using a 10 pitch cutter.

$0.14143 \times 35 = 4.950$ = Pitch diameter.

$4.950 + 0.200 = 5.150$ = Outside diameter.

$0.44431 \times 35 = 15.550$ = Pitch in inches to one turn of spiral.

NOTE.—A slight variation in one turn makes no practical difference, hence the ordinary change gears furnished with a universal miller will usually be found sufficient.

$2.828 \times 35 = 98.980$ = Number of teeth in spur with same curvature.

Looking at B and S spur-gear cutter list, we see that 99 is between 55 and 134, therefore we select a No. 2 cutter.

In a similar manner using 16 as a multiplier we obtain the data for the pinion.

$$\frac{4.950 + 2.262}{2} = 3.606 = \text{Center distance}$$

	Gear	Pinion
Number of teeth	35	16
Pitch diameter	4.950	2.262
Outside diameter	5.150	2.462
Pitch in inches to one turn	15.550	7.108
Angle of spiral	45°	45°
Pitch of cutter	10	10
No. of cutter	2	3
Whole depth of tooth	0.216	0.216
Angle of shafts	90°	
Center distance of shafts	3.606	

Machining Bevel Pinion Blanks

By F. A. Stanley*

A method of finishing small cast-iron blanks for elevating pinions for planer cross rails, on the turret lathe, using a handy and efficient set of tools.

The operations consist of roughing the blank all over with a single-point tool; drilling the hole for the bore; boring nearly to size with an adjustable tool, which produces a true, straight hole; reaming the hole to exact size; finishing the bevel face and large diameter with an inserted-blade forming tool; counterboring the outer end with a flat cutter; finishing the back angle with a straight forming tool on the cross slide.

*Western editor.

The cast-iron bevel blanks shown in the accompanying engravings, are for elevating pinions for the cross rails of planers and the halftones illustrate the methods by which these blanks are machined at the shops of the Cincinnati Planer Company, Cincinnati, O.

First Operation

The first operation in the process of finishing the bevel castings, is represented by Fig. 1, which, with the other engravings, conveys a clear idea of the tool equipment applied to the Acme turret machine for the production of these blanks.

The casting is of the dimensions given in Fig. 2, plus a reasonable amount all over for finishing. It is first held in the three-jaw chuck as in Fig. 1 for the operations performed by the turret- and cross-slide tools, and the first machining cut is taken with the turning tool at the front of the cross slide, which tool is employed to rough out the entire exterior surface of the blank, with the exception of a short portion of the hub which is gripped in the chuck and is therefore beyond the reach of the tools.

The engraving represents the roughing tool about half way down the bevel face of the blank, this cut being taken by operating the cross-slide handwheel to keep the tool under the scale and follow the outline of the casting while the cross slide is fed along the bed by power.

Machining the Bore

The view in Fig. 3 shows the twist drill just starting in to rough out the bore, and the same illustration shows the nature of the adjustable boring-tool holder *A*, which occupies the next position in the turret. It also represents clearly the inserted-blade facing or forming tool *B*, for finishing the bevel face, outside diameter and end of the blank. This tool is seen from another angle in Fig. 4.

The twist drill leaves about 1/64 inch for removal by boring and the single-point tool in the pivoted, adjustable holder *A*; makes it possible to secure a true, cylindrical hole, with little trouble. The boring operation is followed by reaming to size with a floating reamer *C*, which is required to remove only two or three thousandths of metal, merely enough to scrape the bore smoothly, without liability of throwing the hole out of truth.

It should be stated here that for purposes of convenience, the reamer and drill for this particular piece of work, are used in the same hole in the turret, a quick-change socket permitting the shift from drill to reamer to be made in an instant. In Fig. 4, the reamer is slipped into another position from that which it regularly occupies, to permit it to be seen in the photograph of the turret tools.

The Finishing Tools

The inserted-blade cutter head or forming tool *B* which finishes the front bevel of the pinion blank, is used immediately after the reaming of the bore is accomplished, and during its broad facing cut, with the two angular blades *D D*, the tool is piloted in the bore by a revolving shell on a stem extending forward from the shank. At the same operation, the inserted blade tool finishes the outside diameter of the bevel to size and faces the end of the work by a straight-edge cutter *E* inserted at the top of the head.

The flat inserted cutter in the bar *F*, is next brought into service to finish out the counterbore, or depression in the end of the blank, and this completes the work of the turret tools. The final operation in the machine, is performed with the forming tool *G* in the rear block of the cross slide. This tool is carried in an inverted position to make it unneces-

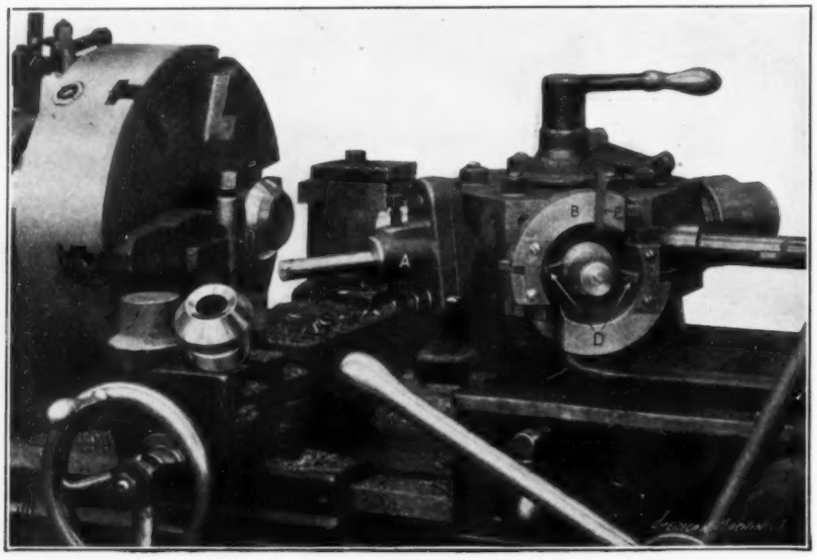


Fig. 1. Machining a Bevel-pinion Blank in the Turret Lathe. First Operation —Roughing the Face

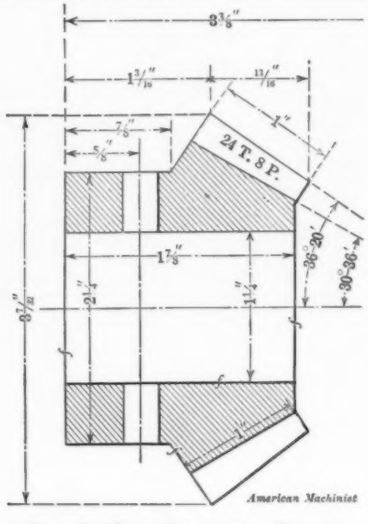


Fig. 2. The Elevating Pinion

sary to reverse the spindle drive, and is fed in to finish the back angle of the bevel-pinion blank, and that portion of the hub which is roughed at the outset with the turning tool at the front of the cross slide.

After the pinion blanks have been machined as described, in the turret lathe, they are placed on an expanding plug held in the spindle of an engine lathe, and with a tool controlled by stops for diameter and end cuts, the short portion of the hub still rough, is turned to size and the end faced to length.

Details of the Adjustable Boring Tool

The adjustable boring-tool holder is shown more clearly in the drawing, Fig. 5, and it will be seen upon inspection of this engraving, that the bar carrying the cutting tool is secured in a head *H*, which is pivoted upon a stud *L*, and provided at the bottom with two opposing screws *J J*, which act against a stud fixed in the lower end of the body *K*. The nut and washer on this stud secure the adjustable head firmly at any point to which it may be set and in conjunction with the opposing screws, hold the movable portion of the tool rigidly to the fixed body.

The Inserted-blade Forming Head

The cutter head *B*, with its inserted tools is shown in section and end elevation in Fig. 6, and requires little in the nature of an explanation further than what has already been said. The method of holding the tools in place will be seen from this sketch; which also shows clearly the straight-faced tool *E* which turns the top of the blank and faces its end while the angular cutters *D D* are finishing the bevel face.

The body of the tool is of steel and it carries high-speed steel tools, made from 1¼x5/16-inch stock. The pilot consists of a revolving shell mounted upon a stud inserted in the body and is retained by a washer and countersunk head screw at the front end.

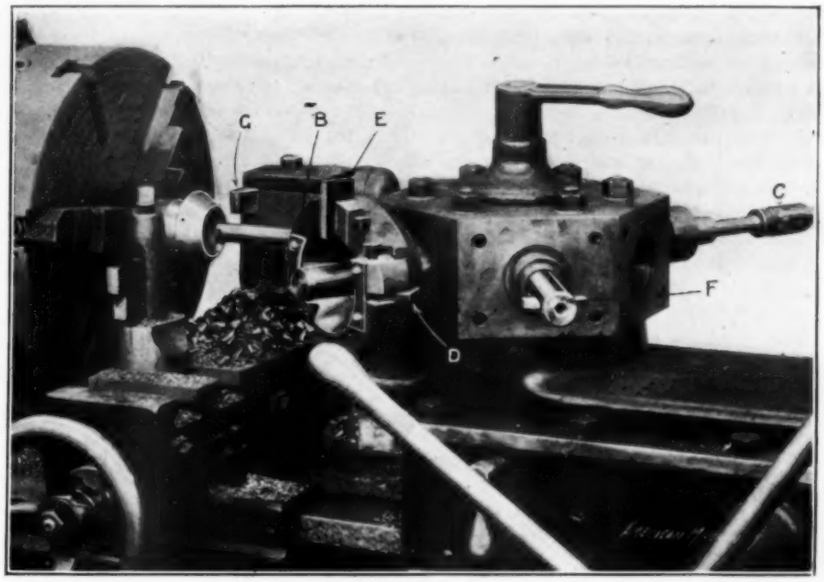


Fig. 4. The Boring Operation and the Bevel-finishing Tool and Counterboring Tool in Turret

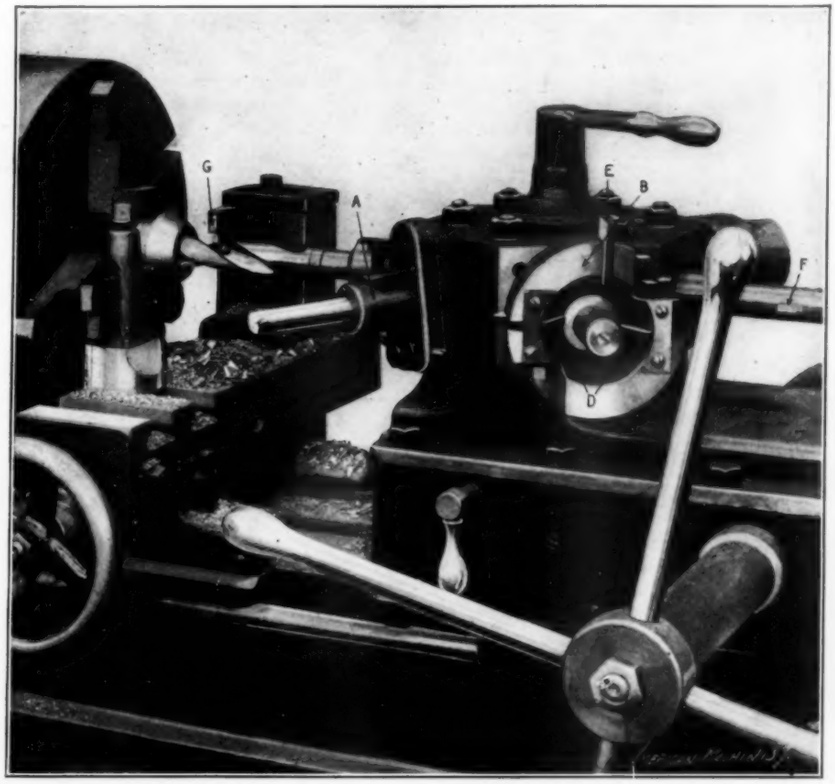


Fig. 3. Drilling the Hole. Showing Also the Adjustable Boring Tool and Bevel-finishing Tool.

Metal for Bearings and Their Proper Lubrication

By J. P. Brophy*

I was very much interested in the letter on page 462, by Edmond S. Williams, Bridgeport, Conn., on bronze boxes.

We have had considerable experience with bearings in the last 20 years, and after tests of all kinds have decided that all things considered, first-class babbitt metal, as far as we are concerned, excels in every particular, and many automobile manufacturers are getting wise to this fact at the present time. I should state, at the start, that the spindle speeds of our machines vary from 30 to 2200 revolutions per minute, and we are satisfied that, regardless of the kind of machinery, this metal may be used for boxes of any kind, and that the results will be entirely satisfactory.

There are metals of every description on the market, many with great claims behind them, but after all is said and done, if you have honest tests made, I think the conclusion will be reached that babbitt metal is the ideal and hard to beat.

Going back 18 or 20 years in our own business, we manufactured bearings for our spindle heads, using a cast-iron shell

*Vice-president and general manager, Cleveland Automatic Machine Company.

similar to the old Pratt & Whitney style, jigging out the holes in various directions, filling them with babbitt and then boring them out. The next operation was peening in order if possible, to make the babbitt tight in the cast iron, then finishing all over.

We regret to recall that even with this kind of bearing, which was supposed to be right at that time, we had all kinds of trouble. It was difficult for us to produce a bearing with babbitt as solid and tight in cast-iron boxes as we thought necessary, especially for automatic screw machines where there is considerable thrust in all directions on the spindle. This same argument would apply to many other kinds of machinery, as well as machine tools, and after a few years we were satisfied that this kind of a box was not the best.

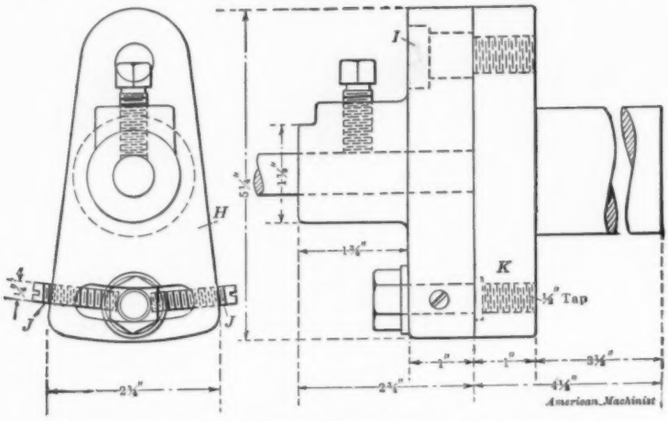


FIG. 5. ADJUSTABLE BORING TOOL FOR THE TURRET LATHE

TRYING OUT BRONZE BEARINGS

We thought, of course, that it would be impossible for us to make a mistake if we decided on bronze bearings, so we purchased bronze castings supposed to be the best bronze obtainable from different foundries, and experienced all kinds of trouble from various sources. The bronze was not to be depended upon. It was sometimes hard and sometimes soft and we made vigorous complaints to the foundries, and the consequence was that our trouble was going on steadily and we decided that bronze was too uncertain for our use and we abandoned the use of same.

We also discovered that as far as lubricating is concerned, bronze bearings are somewhat treacherous if not watched closely. We use very large drills and very heavy box mills for removing stock rapidly, and the end strains on the spindle are exceptionally great, and no matter how we lubricated these bronze bearings we were bound to have trouble. The collar on the spindle would cut into the bronze, and more than this, the bearing proper under the best care was liable to cut the spindle to such an extent that it would have to be replaced, and after all kinds of annoyance from this source, we decided that bronze was not the metal for us to use, and after giving the matter serious consideration we resolved to make a test with A-1 babbitt metal.

GIVING BABBITT A TRIAL

We made up a number of spindle boxes of this metal and used them on machines in our own screw room, doing work on these machines which would test these bearings to the extreme, and the consequence was after six months' test, we decided babbitt metal was good enough for us. In the last 12 or 14 years we have used many tons of babbitt metal for our spindle bearings, which is the most vital part of our machine next to the turret, and rarely ever do we have a complaint from any source—so rarely that if we mentioned the number of people who complained, it would be almost unbelieveable to the readers of this paper.

We fit up our bearings just close enough for lubrication, and if these boxes are oiled with the proper lubricant twice a day, there will never be any trouble from this source, no matter how heavy the job may be.

As far as cast iron is concerned, we all know that it makes a good bearing if properly lubricated. A cast-iron bearing with oil flowing through constantly would be very satisfactory, but the lubricant must be there all the time. We purchased some lathes a great many years ago with cast-iron bearings and discovered this, that in some cases where the bearings were properly taken care of, they remained in good shape for a number of years. They were glazed over and the surface was exceptionally hard and we had no fault to find. However, in other cases where the workmen were careless in oiling, they were all worn out in a very short time and we had to replace them with babbitt.

This matter of bearings is exceptionally interesting to every user of machinery. We all know that slow-running shafts will stand for good cast-iron bearings if they are fitted up properly. If the bearings are in solid (I mean without a cap), the boring and reaming should be the best kind of a job. We have had wide experience with cast-iron bearings on slow-moving spindles and shafts.

THE QUESTION OF LUBRICATION

There is one thing certain, that to most all manufacturers, large and small, the question of lubrication is an important one, and I venture to say that in the general run of cases where bearings have caused considerable trouble, it will be discovered that the workmen or the foreman, or both, are exceptionally careless. While the machines move along without causing any annoyance, they neglect to lubricate, and in many instances, if investigated, it will be found that the poorest kind of lubricant is just as liable to be used as the best. Oil for bearings that is not the best as far as viscosity is concerned, is about as good as so much water, unless it is flowing through the bearings constantly. Very often there is no body to oils that are used on high-grade, expensive machinery. An uninstructed workman is just as apt to fill a can with oil that is to be used on a machine

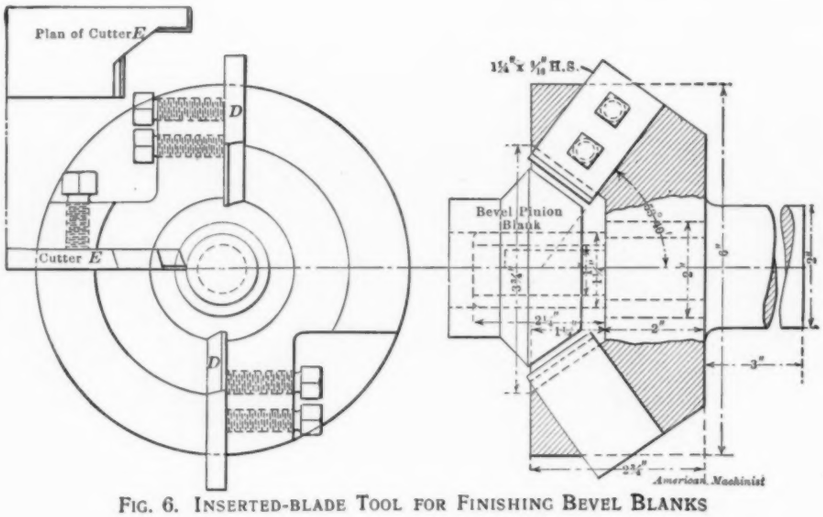


FIG. 6. INSERTED-BLADE TOOL FOR FINISHING BEVEL BLANKS

for ordinary work for cutting tools and which may be of a low grade loaded with chips, or grit, as he is to think of such a thing as being sure the oil he is using is the right kind. Oil that may be used for many purposes, such as drilling, milling, etc., is not the right kind to use for bearings. I am satisfied that workmen would not be guilty of using the wrong lubricant with malicious intent, but that ignorance or lack of instruction regarding the question, is responsible.

Good Oil Saves Machinery

More than this, the superintendents of many institutions are slow to grasp this important point because they are busy in other directions. There should be in each department oil used especially for bearings; that is, a separate can for this class of lubricant and for no other purpose, and if the oil holes are kept clean and lubrication given the best consideration, the life of machinery of all classes will be prolonged from 25 to 50 per cent.

All those who have had experience in factories know that there are many grades of oil liable to be used for different purposes, but that used for bearings in machinery of all kinds should be high priced, because you cannot purchase good oil if you do not pay the price. It may look all right, but it has not got the lubricating qualities.

To go still further into this subject, we will consider the engineer in any plant. From the time of his actual apprenticeship in business it is imbedded into his mind by those who teach him that the bearing of a steam engine is one of the all important things to be seriously considered at all times. Neglect in this respect would mean that the bearings of the engine would soon heat up and destroy themselves, thereby closing down the plant for days and sometimes weeks to make repairs. The fact that the engineer is so well aware of this being the case, is the reason the right kinds of oils are used and the bearings of his engine watched closely, which confirms the argument that the lubrication of machinery from the smallest drill press to the largest tool in the factory must be strictly attended to in order to prolong the life of the machine.

This is not written with the idea of criticizing anyone, but the question of bearings is such a live one that I thought that our experience on this important subject ought to help others.

A Special Grinder

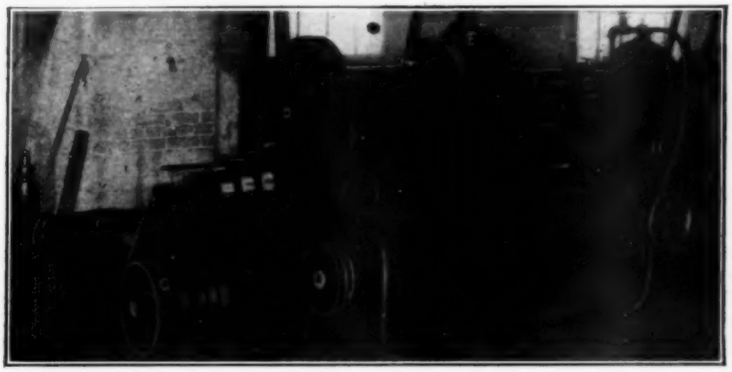
The accompanying halftones illustrate a grinder built by the Bullard Machine Tool Company, Bridgeport, Conn., for the special purpose of grinding both the bevel bearing and the shaft on the spindles of their boring mills which must be absolutely concentric, a condition impossible to obtain unless both are ground at one setting.

The machine is a rigid, powerful one with a 12-foot bed; will grind up to 40 inches round or bevel with the angular head and up to 20 inches with the traverse head. The angular head carries a 2x18-inch wheel and the other, one 2x16 inches.

Fig. 1 shows an end and front view. *A* is the pump; *B* the tank; *C* the feed-driving belt; *D* the belt for driving the spindle gearing in the head; *E* the direct spindle-drive belt; *F* a ground boring-mill spindle; *G* the diamond holder for truing the wheel in the traversing carriage *H*. Originally it was intended to drive the spindle through herringbone gearing in the head, by means of the belt *D* and the cone pulley, but each gear tooth showed so plainly in the work that direct drive from belt *E* is used entirely now, speed changes being obtained through a variable-speed motor.

In Fig. 2 the bevel of the boring-mill spindle is shown at *A*, and the carriage reversing stops, at *B* and *C*.

Fig. 3 is a back view, showing the angular head used when grinding the bevel bearing of the mill spindle, the feeding and reversing mechanism and part of the apron being shown in Fig. 4. In this figure, *A* is the handwheel for traversing the carriage; *B* the feed lock; *C* the screw which carries the reversing arm *D* which strikes the adjustable stops *E E* and throws the clutch *F*. It will be



Figs. 1 and 2. End and Front View of Special Grinder from Opposite Direction

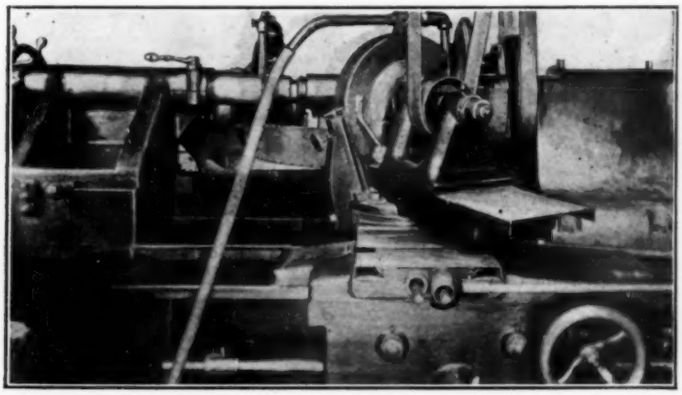


Fig. 3. Angular Head and Carriage

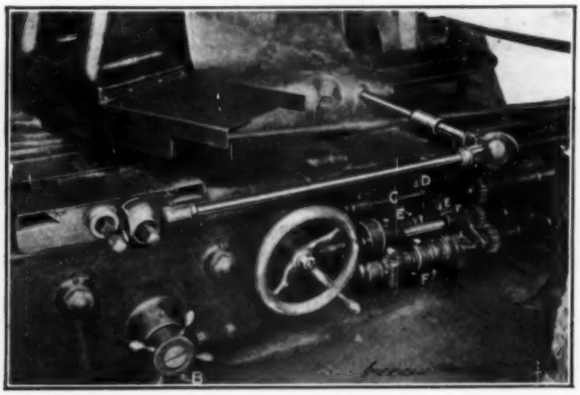


Fig. 4. Apron and Reversing Mechanism

seen from the last two halftones that the angular head may be used for both bevel or parallel grinding and that power feed is obtainable in any position.

This machine was made for use in the Bullard shop only and is not on the market.

Some Milling Done at the Frick Company's Shop

By H. H. Esbenshade

Figs. 1, 2 and 3 show an attachment in use in the shops of the Frick Company, Waynesboro, Penn. It is applied to a Cincinnati plain milling machine. The casting *A* is planed to fit the ways on the column and is provided with a gib so that it can be clamped in place. It is provided with a spindle to drive the cutter

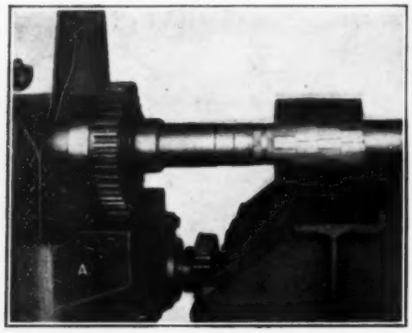


Fig. 1. Two-spindle Milling Attachment

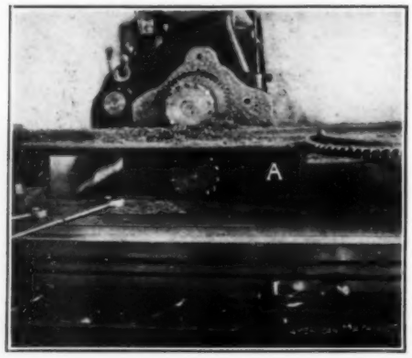


Fig. 2. Front View Two-spindle Milling Attachment

and has a bearing at each side of the spur gear.

By changing the sizes of these spur gears the center distances of spindles can be altered. In Fig. 1 the two cutters are working on faces at 90 degrees to each other. In Figs. 2 and 3 the cutters are working on opposite sides of a casting. The attachment is very satisfactory and a great time saver.

Milling Above and Below Arbor

The illustration at Fig. 4 shows milling both above and below the arbor. This is possible on some classes of work and when it is, will almost double the output. The pieces shown require milling on the edges only and by having a fixture with an extending gap the work is easily inserted and removed.

Fig. 5 shows milling the backs of brass crosshead shoes. Brass is not easily milled with a face mill but by using the fixture shown and an end mill the work is rapidly and well done.

Those who have had experience in milling brass with a face mill will remember that it often becomes a tedious operation but the fixture shown proves very satisfactory.

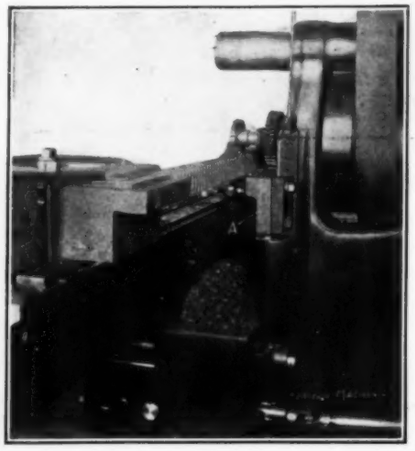


Fig. 3. Rear View Two-spindle Milling Attachment

Cutting a 48-inch Gear

Fig. 6 shows a job which is rather out of the ordinary. It is a cast-iron gear 48 inches diameter, 2 inches pitch, 5 inches face, and was cut on a No. 4 Cincinnati milling machine. The blank was rough turned on the lathe and the teeth roughed out on the slotting machine. A 24-inch faceplate was then fitted to the dividing head of the miller and two heavy parallels fastened to it. The gear was bolted to the parallels. A special jack was then made with set screws to support the wheel near the cut. A profile cutter was made and using the vertical feed, the job was quickly and accurately done.

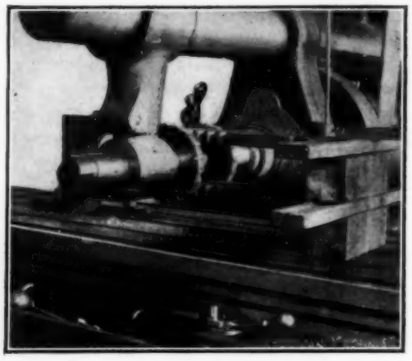


Fig. 4. Milling Above and Below the Spindle

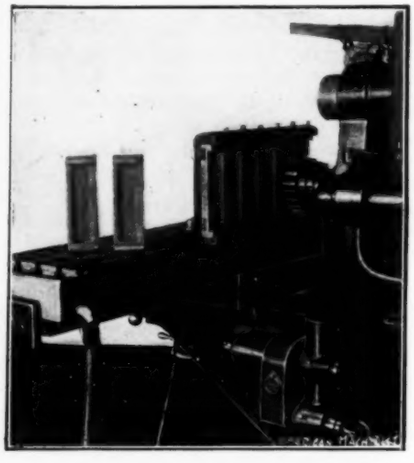


Fig. 5. Fixture Used for Milling Brass Crosshead Shoes

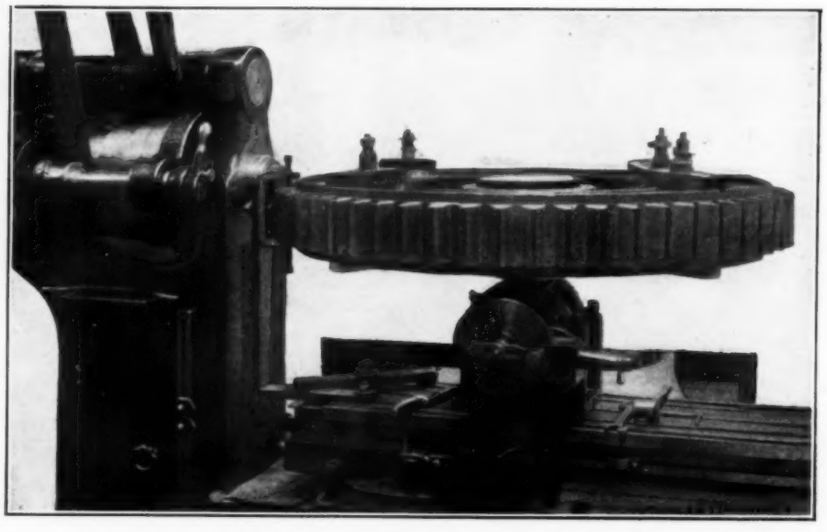


Fig. 6. Cutting a 48-inch Gear

Methods of Holding Punches and Rams

By Ed. E. Eisenwinter

Showing the various holding devices for punches and rams used with or without modifications by punch and die designers.

There are a great many different ways of securing punches and rams and it would be impossible to lay down hard and fast rules when and where to employ any specific method. The choice of any method will depend largely on conditions of use and construction, and it must be left to the judgment of the designer which method is best suited for his purpose. It is not the purpose of this article to show all the various modifications of which each method shown is capable, but rather to present a number of accepted means for holding vertical and horizontal punches and rams, presenting each method as a type, embodying its principal features in the illustration of this type.

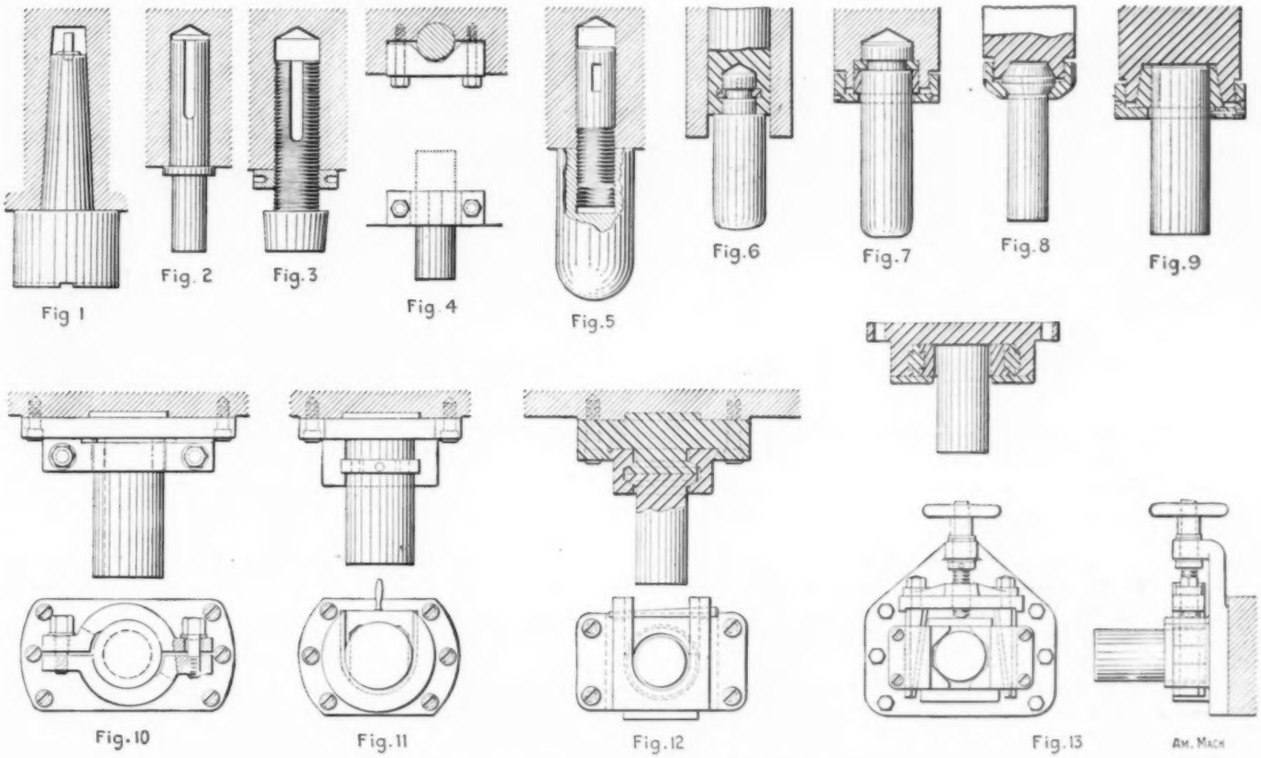
Fig. 1 shows a method largely employed with drop hammers. The shank of the punch or die holder is slightly tapered and forced up into the hammer. A slot, properly located and passing through the hammer serves for the insertion of a drift for driving out the punch. This construction is used almost universally in the stamping and embossing of jewelry and flat silverware. In this case shallow grooves are cut in the bottom of the die holder, at right angles to each other, as shown in the illustration. The die proper has strips on its upper side to correspond with and fit into these grooves, and is forced onto the tapered shank holder.

Fig. 2 illustrates a cheap and simple way of holding a punch in the ram. The thrust is in this case taken by the collar which is in one piece with the punch. To insure proper registration with the die, the set screw used for securing the punch engages in a featherway in the punch shank. In case the adjustment of the gate in which the punch is used is not sufficient, further adjustment can be secured by placing shims between the punch collar and the bottom of the gate or punch holder. The method shown in Fig. 3 recommends itself for use where more than one punch is used in the same gate at the same time; as, for instance, in cut-and-carry operations. In these cases it is desirable to have a quick and easy way of adjusting the various punches independent of each other. The punch holes in the punch block are reamed exactly to size, while the punch shanks are threaded with a comparatively fine pitch. The upward thrust is taken by a nut on the shank. It is advisable to have this nut case-hardened, especially when this nut has been standardized and can be used with other punches as well. As in the method shown in Fig. 2, a featherway cut in the shank of the punch serves to register the punch properly with the die.

In Fig. 4 we have an illustration of a simple and very powerful grip for holding a punch. It is used extensively in single-acting power-press practice.

The clamping action on the punch shank is so powerful that the use of registering pins can be dispensed with, even in cases where the punch is used for stamping parts which are not perfectly circular.

The method illustrated by Fig. 5 combines several excellent features which have made it universally popular. As shown in the drawing, the punch proper and the punch shank are two separate parts, the shank being threaded into the punch. The adjustment of the punch is secured by means of this thread. The shank is provided with a wedge slot and a wedge which passes through gate or punch block; if such is used, draws the punch up against the bottom of the



METHOD OF HOLDING PUNCHES AND RAMS

punch block or gate. The upward thrust on the punch is taken by the bottom of the punch holder and not by the threads on the shank, making this construction an extremely rigid and strong combination.

Fig. 6 gives an illustration of an old method largely employed for holding the central or drawing punch of double-acting power presses. In most cases the construction of the sliding gates of double-acting power presses is such that the inside or drawing slide is within the outside or cutting slide. Therefore, while the drawing punch always can be inserted into its slide from below, it is difficult to lock the same from below. The construction shown in Fig. 6 recognizes this difficulty and surmounts it by using a hairpin yoke as locking member, introducing the same through a properly located opening in the outside or cutting slide. After this yoke has been placed in position it is locked there by means of a large-headed fillister-head screw, the shank of which screws into the body of the drawing slide while the lower part of its head enters into a properly sized and shaped slot in the periphery of the yoke. It is evident that the outline of both ends of the yoke must be circular and of the same diameter as the outside of the drawing slide.

The next illustration, Fig. 7, shows a method similar to that given in Fig. 6, but different insofar as both punch shank and locking means are introduced and secured from below. The locking yoke or collar is clamped against a shoulder by means of a clamping collar and nut. In case it is necessary to use the punch always in the same fixed position relative to the die, this can be accomplished by milling the locking slots in the punch shank straight across and making them a snug fit in a square inside opening in the yoke. It will then be necessary to fix the location of the yoke by means of two dowels or some similar means. This method therefore will lend itself more particularly to use on round punches, or where the punch can be used in any position. The locking collar may then be made circular in its inside opening as well as on its outline, cut in halves, and the locking groove on the punch shank, also circular, corresponding in its dimensions to those of the inside opening of the locking yoke.

The following two methods, Figs. 8 and 9, will commend themselves in cases where it is necessary to insure a very high degree of perfection as regards centering the punch.

Fig. 8 will need little explanation. Care should be taken that there is good clearance between the straight parts of punch and the locknut, also that the punch does not bottom as a snug fit in the straight parts, or bottoming, would defeat the very end sought, namely, perfect centering.

Fig. 9 combines perfection of centering with simplicity and cheapness of punch construction. The conical-shaped clamping ring is split into three or four sections after turning. When the lock nut is loosened and the punch withdrawn these sections are apt to fall together toward the center and the sectioning slots therefore must not be so wide as to allow the sections to collapse entirely and fall out. In order to facilitate the introduction of a new punch the top of the punch as well as the mouth of the clamping sections should be tapered. When using this construction with a vertical punch gravity will cause the clamping sections to follow the nut downward when it is loosened, in which case the construction shown on the left half of Fig. 9 is sufficient. However, if this method is employed with a horizontal punch or ram, some means must be introduced to force the clamping sections outward with the nut when it is loosened. The construction shown in the right half of Fig. 9 will accomplish this result satisfactorily.

In the preceding illustrations, I have had in mind punches of small and medium sizes acting vertically; the succeeding methods refer more especially to cases where the punch or ram is of large proportions and sets in a horizontal line.

A very simple but at the same time very effective method is shown in Fig. 10. The punch-holder casting is bolted to the sliding gate. To insure perfect concentricity of punch holder and sliding gate, two dowel pins should be used, or as in the illustration, a circular disk shoulder should be turned on the punch holder fitting into a recess in the gate. The clamps are cast in one piece with the punch holder and the upper half separated from the lower half by a saw cut. About three-fourths of each half of the clamp is separated from the base of the punch holder, allowing the remaining one-fourth to be connected with the base. The clamping action is obtained by means of two good-sized bolts, the bolt head resting on a washer convex on its under side. To grip a punch of a diameter smaller than the bore of the clamps, a split ring should be used as a filler, as shown by dash and dot lines in the illustration.

Another simple method for holding a horizontal punch is shown in Fig. 11. This method commends itself in cases where the room available for inserting the punch is limited, as in this method the punch is inserted from above. The seat for the punch shank is U-shaped and a hairpin yoke is used for locking purposes. In most cases it will not be necessary to fasten the yoke in position, depending on the weight of the yoke to keep it rigid, although it will be a simple matter to secure the yoke effectively.

In Fig. 12 we have a method which combines the advantage of being able to insert a horizontal punch within a limited space with the factor of holding the punch in absolutely perfect concentricity with the punch holder and sliding gate. Central with the punch holder, and part of the same, is a tapered stud. The punch, the end of which is tapered in a direction opposite to the taper on the stud, is brought to butt against this stud. A U-shaped lower clamp, sliding in the punch holder and having a V-shaped groove fitting the two tapers on punch and stud, is made to straddle the two. A top clamp, sliding within the lower clamp and also having a V-shaped circular groove is placed on top of punch and stud and by means of a wedge the two clamp parts are drawn together. The V-shaped clamp grooves, drawn against the taper on the stationary stud, force the center of the punch to coincide with the center of the stationary stud, and at the same time lock the punch securely. In order to prevent the U-shaped lower clamp from sliding out when the wedge is withdrawn, a guard strip is provided on the bottom of the punch holder.

Fig. 13 illustrates a powerful grip for a horizontal punch of large dimensions, which has the advantage of requiring no tools for its operation. Two sliding blocks, one on either side of the punch, being cut V-shaped where they grip the punch, are forced against the punch by means of wedges. The two wedges are fastened to a yoke and moved together by means of a screw and handwheel. To force the grip blocks to move outwardly when it is desired to remove the punch, the wedges are dovetailed into the blocks as well as in the backing, as shown in cross-section *A B*. To assure a parallel motion of the grip blocks, shelves are provided on top and bottom of the blocks. Altogether this combination of screw wedge and V block, makes a very effective and at the same time centralizing grip.

From the *Oil and Gas Journal* it is noted that California produced in 1910 at least 50,000,000 barrels of crude oil that is fit for use at the well, in gravity ranging from 11 to 25 degrees Baumé, much of it below 20 degrees, or not above that. Texas and Louisiana in 1910 produced at least 7,000,000 barrels of crude oil fit for straight fuel, gravity 17 to 23. Oklahoma and Kansas produced in 1910 about 2,000,000 barrels of crude oil fit for fuel, gravity 27 to 30 degrees. Illinois produced in 1910 about 1,000,000 barrels of crude oil fit for fuel, gravity 26 to 3. These figures are quoted in round numbers, to give an approximate idea of the straight fuel-oil production of the United States in 1910, with no expert or technical analysis of the quantity and varying qualities of the grades that fall within the degrees of gravity that permit use direct from the well.

In the Maxwell-Briscoe Factory

By Ethan Viall *

Method of laying out the crank and gear cases to insure their machining properly.

A few milling and drilling operations. Drilling both cam-shaft holes at once by the use of a jig with hinged drill guides.

*Associate editor.

Like the majority of first-class automobile factories, the Maxwell-Briscoe Motor Company, Newcastle, Ind., has many special machines and devices to be found nowhere else, and though these devices in their entirety could not, with few exceptions, be used elsewhere, yet the mechanical principles involved are interesting and instructive.

Many of the ingenious jigs and fixtures in use are the design of F. C. Swain, mechanical engineer, and it is to him we are greatly indebted for time and information which was given us while in the factory. Thanks are also due to the general manager, F. F. Smith and the superintendent, H. S. McClellan, for permission to describe the factory methods and for other courtesies.

Laying out the Cases

In this article we shall take up principally the operations on gear and crank cases. In most automobiles the gear and crank cases are made separately but in the Maxwell-Briscoe car, they are made in one casting. These castings are laid out on a surface plate fitted with a jig as shown in Fig. 1 and carefully gone over with the tools and hight gages illustrated in order to see whether there is sufficient metal to machine properly, as mistakes in casting or the warping of the metal, may render the casting unfitted for use, and unless this preliminary laying out was done, considerable machining might be done on the casting before it was discovered that it would not clean up entirely.

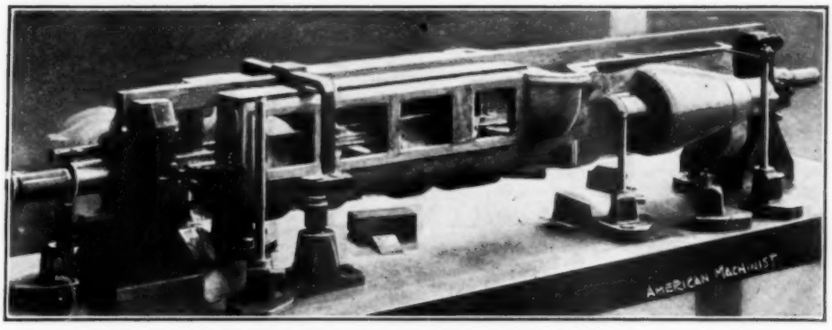


Fig. 1. Laying Out Crank and Gear Cases

Milling

After being carefully laid out and the inspector assured that the casting has sufficient metal to machine properly, it is sent to an Ingersoll miller and milled as illustrated in Fig. 2. The casting is next placed in another jig on a similar machine and using the surfaces already finished to locate by, the sides are milled, after which it is sent down the line of drillers shown in Fig. 3, where the various stud, anchor and shifter-shaft holes are drilled and reamed; the stud holes are also tapped in one of these drillers. From this row of drillers, the case goes to the radial illustrated in Fig. 4, and the transmission countershaft holes are drilled and counterbored, both top and bottom, the facing being done with the tool shown lying on the platen. The inside ends of the holes are faced by running the body of the tool down through the hole, inserting the cutting blade and then drawing the cutter up against the work.

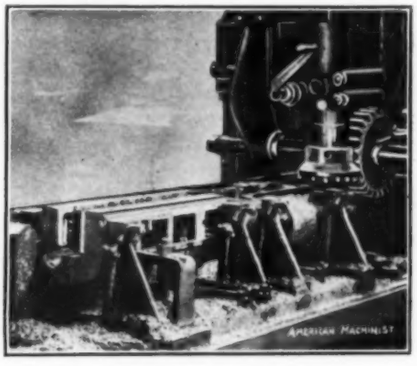


Fig. 2. Milling Cases

Fig. 5 shows a special machine used for boring main bearings. This machine

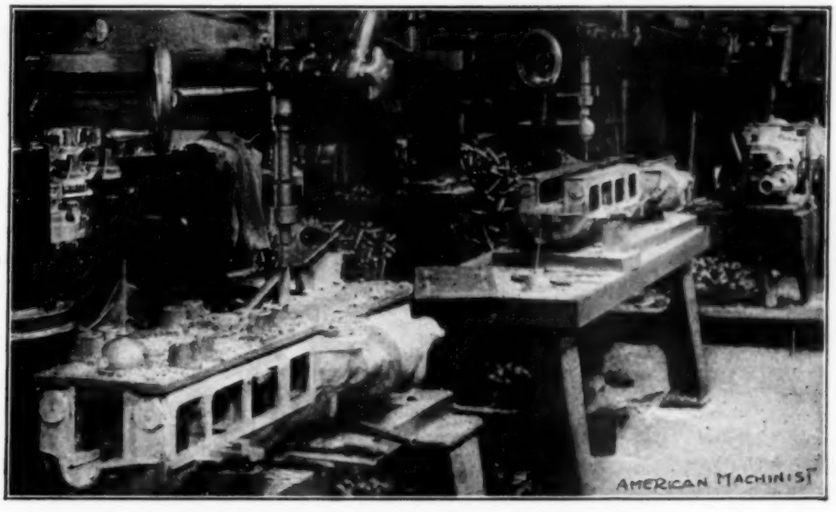


Fig. 3. Some of the Drilling Operations

Fig. 4. Drilling and Counterboring Countershaft Holes

was made especially for the purpose and has a bed 14 feet long, the extra length being required on account of the unusual length of the combination crank and gear case. The halftone shows plainly the method of clamping the case into the machine and also the method of guiding the drill or boring tool.

The gear cases are bored and faced in a regular horizontal boring mill, but are held in by using the special jig shown at to hold the case in position and guide the drill, is interesting and is shown in detail in Fig. 8. As this figure shows, the drill guides may be thrown back in order to insert the case into the jig and after the case is securely clamped in place, these guides are thrown forward and the drilling is carried on with the assurance that the drill cannot go far out of the way. During the drilling operation the drills are flooded with lubricant

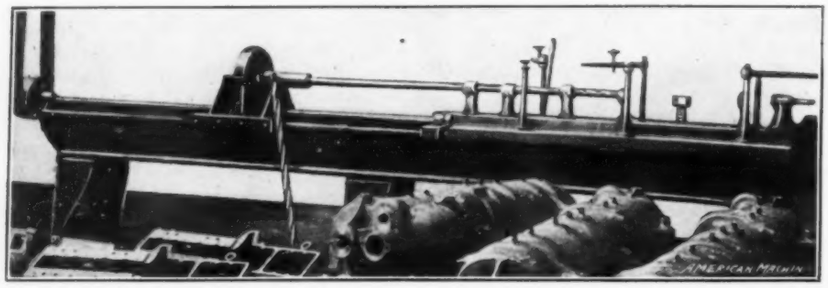


FIG. 5. A SPECIAL BORING MACHINE

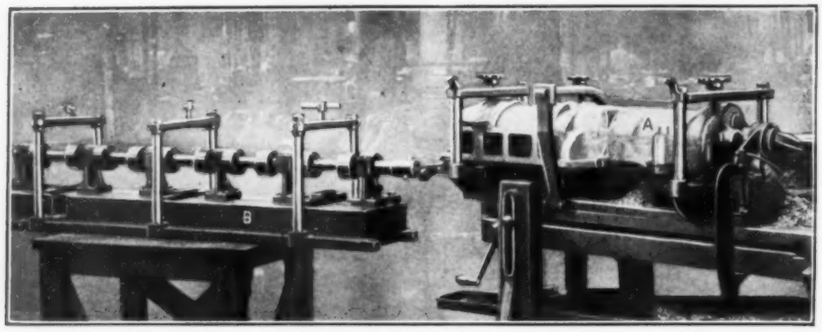


FIG. 6. BORING GEAR CASES AND JIG FOR FACING ENDS OF MAIN BEARINGS

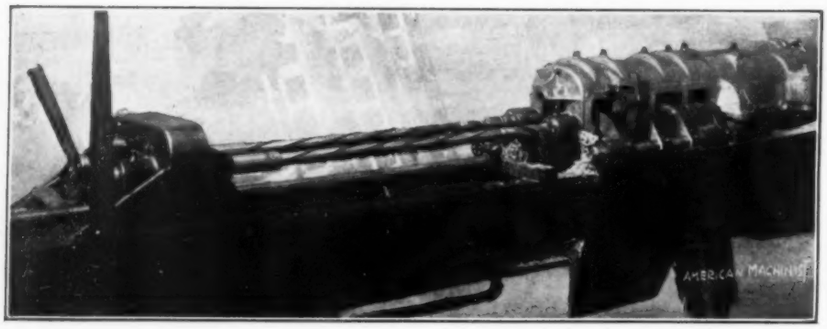


FIG. 7. MACHINE AND JIG FOR DRILLING CAM-SHAFT HOLES

A, Fig. 6. At *B* in this halftone is shown a jig used on the same machine for facing the ends of the main bearings, all of which are finished at one operation.

MACHINE AND JIG FOR BORING CAM-SHAFT HOLES

Another special two-spindle machine, used for boring out both cam-shaft holes at the same time, is shown in Fig. 7. The jig or fixture used on this machine from the pipe *C*, in the middle of the jig. As this illustration also shows, the drills used are the ordinary standard make, the long bar being made so that any regular drill may be inserted in the end.

REAMING STAND AND JIG

Fig. 9 shows a stand and reaming jig used while hand reaming the cam-shaft holes, previously rough drilled in the machine just illustrated. These stands are very convenient as they can be swung in any position and the reamers are guided by the use of the jig shown, which has a long locating bar, inserted in the main bearing, insuring the proper distance and alinement of the cam-shaft holes relative to the crank-shaft bearings. One of these reaming jigs is shown lying on the floor at the foot of the stand.

An interesting feature of a great deal of the reaming done in this factory, is that the reamers are run by means of air drills wherever possible, although on some of the reaming operations this is not practicable, but it is a great time and strength saver wherever it can be used. In our next article we will take

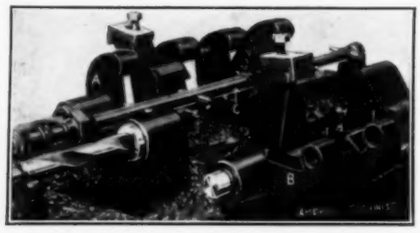


FIG. 8. DETAILS OF CAM-SHAFT HOLE-DRILLING JIG

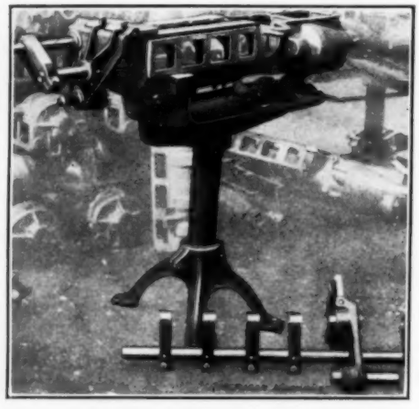


FIG. 9. REAMING STAND AND JIG

up some of the special jigs and fixtures used for the smaller parts and also show some of the machining methods on the cylinders.

A consular report originating in Germany states that motors of the Diesel principle, ranging from 5 to 30 horsepower, are becoming a commercial product, crude oil to be used as the fuel. Economy of this particular fuel over gasolene is not the only claim for the new engines, but the danger of handling crude oil is very much less than that involved in handling gasolene and the storage of the fuel is much simpler. The small motors having been constructed on the Diesel principle have neither carbureters, igniters, or magnetos.

Horsepower of a Fan Blower

By Albert E. Guy

The results of some tests showing the influence which the form of the vanes has upon the horsepower and the head produced. Formulas are given showing the approximate velocity of flow and horsepower developed.

A problem frequently met with is that of finding the horsepower of a fan blower when the diameter of the rotor, width of vanes at the tip, etc., are known. This typical problem may be solved only when the necessary data embodied in the "etc." are known; otherwise it may be readily shown that two fans, having the same inlet and outlet diameters, the same width of blades, revolving at the same rate of speed and delivering the same volume of free air per unit of time, may produce widely differing pressures. Thus, with the lower pressure, the air horsepower would be almost negligible, while with the higher pressure, which might be an extreme for the class of fan considered, the air horsepower, and consequently the shaft horsepower, would be matters of prime importance. This discrepancy is due simply to the fact that in either case the vanes, although of the same width, must be designed to suit the required conditions of pressure.

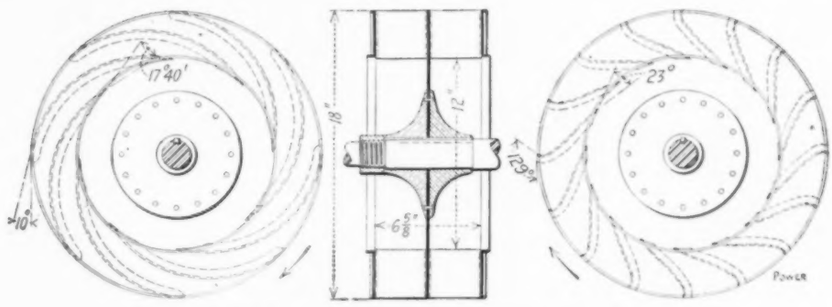


FIG. 1. IMPELLERS USED SHOWING CURVATURE OF VANES

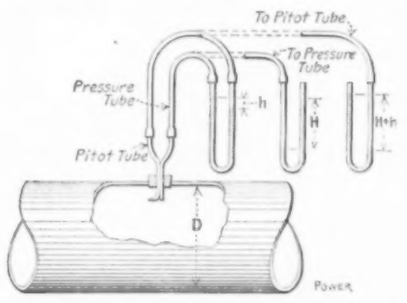


FIG. 3. DEVICE FOR MEASURING PRESSURE IN PIPE

About two years ago in order to show the direct applicability of centrifugal-pump formulas to the design of fan blowers and to prove that a complete line of standard apparatus could be designed without making preliminary and special experiments for obtaining so called coefficients of correction, I chose two extreme sets of conditions and designed special apparatus to meet them.

It was proposed in one case to furnish 7000 cubic feet of free air per minute at a static pressure of 22 inches of water, and in the other, 5250 cubic feet of air per minute at a pressure of 5 inches of water, the speed being 3600 revolutions per minute in both instances. A spiral form of casing was designed, and an impeller fitted into it, each set of conditions being met by a special impeller; but to add to the difficulties and to render the proofs more conclusive, the inlet and outlet diameters, and the width of the vanes, were kept the same for the two impellers. Fig. 1 shows the principal dimensions and forms of the impellers.

When completed, the apparatus was connected directly to a steam turbine and the high-pressure impeller driven at the specified speed. To determine the capacity of the fan and to obtain the curve showing the relation of volume to head, the speed was kept constant while the volume delivered was progressively increased by changing the nozzle areas at the end of the discharge pipe. The head was recorded simultaneously with the volume to which it corresponded. Various speeds above and below that specified were tried in the same way, the results being shown by the series of curves given in Fig. 2.

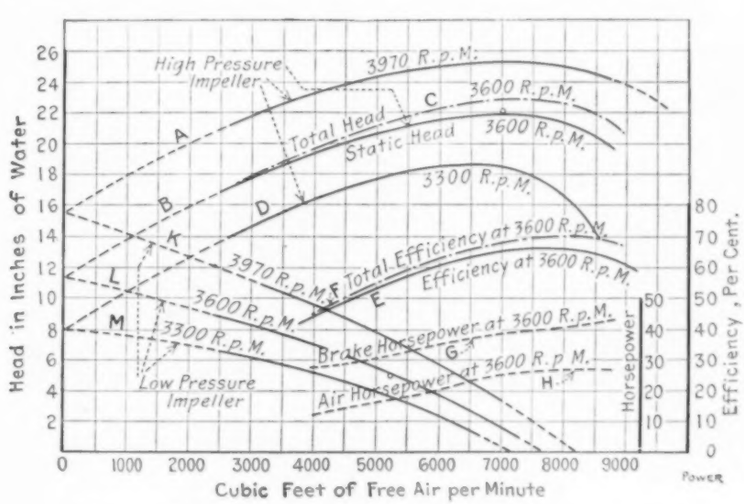


FIG. 2. CHARACTERISTICS OF THE TWO IMPELLERS TESTED

The steam and exhaust pressures at the turbine were recorded for each point of the curve, not for the purpose of ascertaining the steam consumption, but in order that later on, the blower being disconnected and replaced by a prony brake, the same steam and exhaust conditions could be reproduced at the proper speed and the corresponding brake horsepower recorded. With the latter data the efficiency of the apparatus was obtained and is represented by curves covering the useful range of the impeller.

The low-pressure impeller was tried next, but on account of the small amount of power required to drive it and the unsuitability of the turbine for the purpose of measuring that power, it was not possible to ascertain the efficiency with sufficient accuracy to permit representation by curves, as was done with the first impeller. However, it was observed that for the point aimed at in the design, the efficiency was not less than 60 per cent.

The curves *A* to *H* in Fig. 2 are for the high-pressure impeller and curves *K*, *L*, *M* are for the low-pressure impeller. It is apparent that neither impeller was suitable for the requirements of ordinary work. The usual requirements are that a practically constant head be maintained

for a wide range of volume variation. In the present case such a condition could have been met only by varying the speed, and the turbine was not well adapted for such a speed variation.

However, a comparison of the capacities of these two fans is interesting. At 3600 revolutions per minute 7000 cubic feet of free air were delivered against a head of 21.8 inches of water by the high-pressure fan, while the same quantity was delivered against a head of 1.6 inches of water by the low-pressure fan. The air horsepowers were nearly proportional to the heads, or in the ratio of 13.6 to 1. At the same speed and for a volume of 5250 cubic feet of free air per minute, the brake-horsepower ratio would be about 4.5 to 1.

The impellers illustrated by Fig. 1 are not recommended for practical work. The speed of 3600 revolutions per minute is too low for the high-pressure impeller, or, the latter's diameter is too small for the speed. Moreover, the reversed form of vane is not desirable, as it entails a great frictional loss, and while it is theoretically correct for turbine work, it is not so for pumping purposes. The speed of 3600 revolutions per minute is far too high for the low-pressure impeller; the vanes are consequently too long and entail a frictional loss out of proportion to the head worked against.

These two impellers, however, served to demonstrate the proposition as intended and further illustrate the fact that it is not possible to determine the horsepower required for a given blower, when only the diameter, width of blades and the number of revolutions per minute are known. It is necessary to know also the inlet and outlet angles of the vanes, the equation of their form, and the equation of the areas of passage from the inlet to the outlet of the impeller.

It is true that for a certain line of standard machines it is possible for the manufacturer to establish a set of approximate horsepower curves which are very useful for estimating; but such information is never given to the user of the machines.

When the fan takes the air from the atmosphere and delivers into a duct, and particularly when that duct or pipe is circular, it is comparatively easy to measure the approximate capacity of the apparatus when the air handled is at a moderate temperature. The instrument needed for the operation is very simple and can be easily made. Fig. 3 represents a combination of Pitot and pressure tubes connected to a glass U-tube containing water. The end of the assembled tubes should be inserted into the delivery pipe as shown. A straight part of the pipe should be selected where the flow is not likely to be disturbed by the influence of bends, valves, etc. The gage should be inserted into the pipe for about one-sixth the diameter and turned so that the open end of the Pitot tube is against the current. If the tube is not so placed the readings will not be correct.

With the two rubber tubes in place the difference in the hights of the columns of water in the U-tube shows the velocity head causing the flow in the duct. Disconnecting the Pitot tube from the glass gage and measuring the hight between the two levels, will indicate the pressure head against which the air is delivered. Again connecting the Pitot tube and disconnecting the pressure tube, will show, by the difference in the hights of the water columns, the total head produced by the fan. This total head is composed of the static head measured by the pressure tube, plus the velocity head shown when the two tubes are used together.

Calling the velocity of flow v feet per second, the velocity head h inches of water, and the static pressure head H inches of water,

$$v = \sqrt{2g\frac{p}{d}} = \sqrt{\frac{1{,}746{,}700 \times h}{406.7 + H}} = 1321\sqrt{\frac{h}{(406.7 + H)}}$$

where,

p = Pressure in pounds per square foot;

d = Weight, in pounds, of one cubic foot of free air at 50 degrees Fahrenheit = 0.077884;

406.7 = Inches of water corresponding to atmospheric pressure.

Knowing the inside diameter D, in inches, of the delivery pipe, the volume discharged in cubic feet per second is

$$\frac{\pi D^2}{4 \times 144} \times v$$

But this air is at a pressure H and the corresponding volume of free air per minute would be

$$\frac{\pi D^2 \times v \times 60 \times (406.7 + H)}{4 \times 144 \times 406.7} = \frac{D^2 \times v \times (406.7 + H)}{1242}$$

cubic feet per minute

The horsepower in air delivered would be

$$\frac{\textit{Volume per minute} \times \textit{pressure per square foot}}{33{,}000}$$

One cubic foot of water weighs 62.35 pounds; one inch of water equals

$$\frac{62.35}{12} = 5.196 \textit{ pounds per square foot}$$

Hence,

$$\frac{\textit{Volume per minute} \times 5.196 \times H}{33{,}000} =$$

***Air** horsepower*

or

$$\textit{Air horsepower} = \frac{\textit{Cubic feet per minute} \times H}{6350}$$

Substituting for the volume and velocity their respective values:

$$\textit{Air horsepower} = \frac{D^2 \times v \times H \times (406.7 + H)}{6350 \times 1242} =$$

$$D^2 \times H \times \left(1321\sqrt{\frac{h}{406.7 + H}}\right) \times (406.7 + H) = \frac{D^2 H \sqrt{h \times (406.7 + H)}}{5970}$$

As the efficiency of ordinary blowers is about 50 per cent., multiplying the air horsepower as just obtained by 2 gives approximately the shaft horsepower necessary to run the blower. While reading the gages the speed should be kept constant, and the time selected when the flow of air is uniform.

The gage readings and particularly that of the velocity head should be very close, for which reason it is preferable to use a U-tube of rather small diameter.

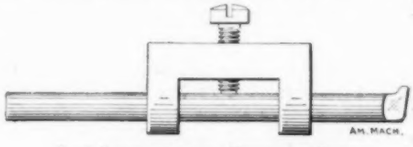
The formulas herein given are intended for approximate work only. The density of the air depends so much upon the temperature that the method would not apply to hot-blast work, for instance. Corrections should also be made for altitude and humidity. However, if the proper constants were determined to suit a given installation, the formula as modified would be found very useful.

An Adjustable Boring Tool

By Chas. N. Hubbard

A handy little device is shown in the illustration. It is a boring tool for use in the miller and its merit lies in the simplicity with which it can be adjusted for size.

It is made of 3/16-inch drill rod to be held in a draw-in chuck. It is given a spring temper for a couple of inches back from the point, and carries a yoke.



An Adjustable Boring Tool

Turning in the screw bends the bar, and increases the radius of its sweep. A quarter-inch hole is about the smallest that it will bore, and from that up to 5/16 inch is about its range.

In painting steel cars, the special committee of the Master Car Builders' Association recommends that one-quarter hour of labor be allowed per pound of paint applied. On all rivets ½ inch diameter or over, 12 cents net per rivet is allowed, which covers removal and replacing of rivets, as well as removing, fitting, punching or drilling holes when applying patches, or splicing and replacing damaged parts, but does not include straightening. On all rivets ¼ inch diameter and less, and less than ½ inch, the rate is 7 cents. Straightening or repairing parts removed from damaged cars is allowed for at the rate of 60 cents per hundred pounds.

How Drop Forging Die Is Laid Out

By E. A. Dixie

An elementary description of how the dies for a pair of drop-forged pliers are made.

The term "drop forged" to many machinists conveys but a vague suggestion of a piece of hot steel formed between a pair of dies, in each of which is an impression of one-half of the finished product.

While this is true, it is only part of the story. This little article is for the information of those who know nothing about drop forging, and as an example I have chosen a die for making a tool which is familiar to us all, a pair of pliers.

First the design is made in the drawing room. When this is satisfactory a tracing is made but not an exact tracing, for several things have to be allowed for. The hot steel will shrink; a certain amount must be left for finishing those parts which are to be machined, and the die must be given sufficient taper to permit the easy removal of the forging. The shrinkage is about ⅛ inch per foot, the amount allowed for machining is in this case about 1/64 inch a side and the taper about 10 degrees. In other work the amount left for finish may be anything from three or four thousandths to ¼ inch or more and the taper from 7 degrees up.

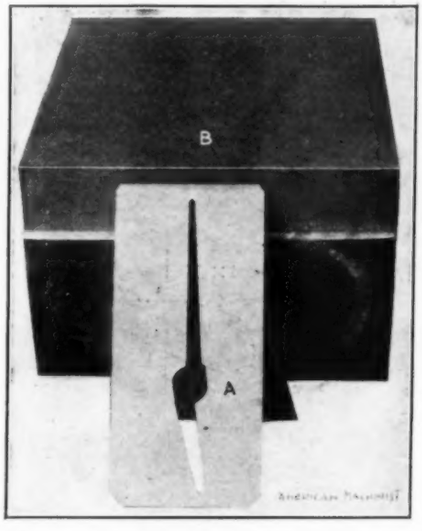


FIG. 1. THE DIE BLOCK AND TEMPLET

After the tracing has been made a piece of heavy sheet tin is taken, the tracing laid on it and the outline is prick punched through. The metal is then removed on the inside of the punch marks and we have a templet as shown at *A*, Fig. 1. The die blocks *B* are then planed with a dovetail on the bottom, to fit in the drop and in the base of the drop hammer. The top surface is planed parallel to the bottom, and one side and one end are planed square with each other to facilitate laying out. The planed die block *B* is first coppered with sulphate of copper and water in the usual way. The templet is then used to scratch the outline of the die on the block. Straight lines are scratched on the templet and similar lines on the die blocks, to assist in locating the templet on the block so that the upper and lower dies will match when in place in the drop press. After the dies are laid out they go to the die-sinking machine, which is somewhat similar to a vertical miller. The die block is secured to the table, which is mounted on slides operated by handles. Cutters similar to end mills or profiling cutters are used and the impression is gradually worked out as far as the machine will work it. From time to time as the work progresses melted lead is cast into the impression, and these casts are checked up to see where the die varies from the original design.

Fig. 2 at *A* and *B* shows finished upper and lower dies and at *C* is shown a lead casting. At *D* is a pair of finished pliers. As it would be impracticable to take square or round stock and by hammering it between the impressions produce the finished piece, the die is so formed at different parts as to work the piece gradually into the most suitable form for

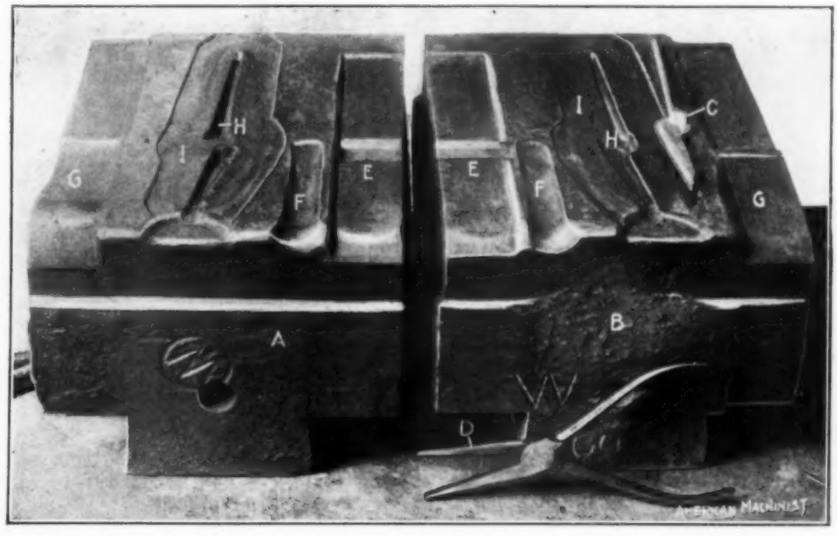


FIG. 2. FINISHED DIES, A LEAD SAMPLE AND A PAIR OF FINISHED PLIERS

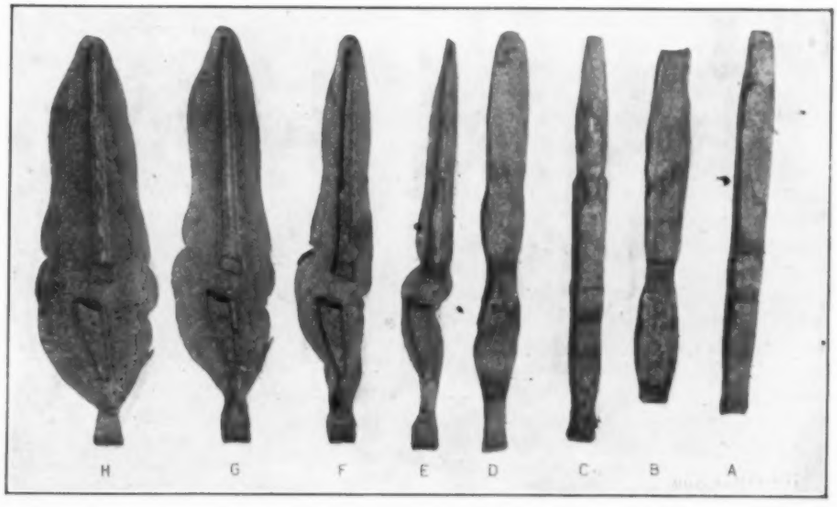


FIG. 3. A DROP FORGING IN EIGHT STAGES MADE BY 11 STROKES OF THE DROP

shaping in the impressions. Fig. 3 shows the evolution of a forging made in the dies shown in Fig. 4. For this particular work ⅜-inch square steel should have been used but as this size was not in stock 7/16-inch steel was used.

The parts marked *E E*, in Fig. 2, are called "rollers." They leave the metal full size at the point where most metal is required but thin it off at each end. The hot bar is put first in the "rollers" and *A*, Fig. 3, shows it after the first drop. At *B* it is shown after the third stroke. It is then transferred to the "pointers" *F*, where it is given two blows, the result being shown at *C*, Fig. 3. From there it goes to the "benders" *G*, which bend it so that the jaw is on a higher plane than the handle. *D*, Fig. 3, shows the result of two blows in the bender. The piece is then removed to the impression *H*,

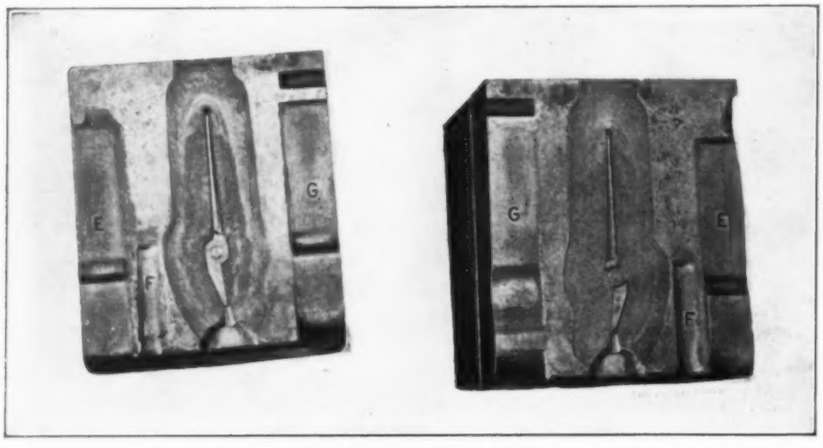


FIG. 4. THE DIES IN WHICH THE PIECES IN FIG. 3 WERE MADE

Fig. 2, and receives four strokes, shown at *E*, *F*, *G* and *H*, respectively. It has taken 11 blows to bring the forging up to the form shown at *H* and during this time it is, of course, still part of the bar which serves as a handle. The forging is then severed from the bar in a shear near the drop or in the drop itself. As it is impossible to have exactly enough metal to fill the dies each time, a little more than is necessary must be used and provision must be made for the excess to flow out of the die in the form of a fin or "flash" as it is called. In the die shown the "flash" allowance is about 0.030 inch.

A pair of dies similar to those shown take a man about 2½ weeks to make. They are hardened in water and the face is left as hard as fire and water will make it. No one can tell how many pieces a die will turn out but for the piece shown from 35,000 to 40,000 pieces would be reasonable. The dies should be finished as smooth as possible. In time they begin to check and crack around the edges. This will finally spoil the die so that it has to be recut. When recutting becomes necessary the old impression is entirely planed off as the face, with use, becomes decarbonized and will not harden unless the decarbonized part is removed.

The flash is removed in a trimming die similar to an ordinary blanking die. The face of the trimming punch is, however, made to conform to the forging so as not to distort to it when pushing it through the die.

Long Addendum Gears*

BY E. W. WEAVER

The bevel driving gears in the rear axle have probably given more trouble to automobile makers and users than any other two gears used on a car. For that reason any system of gear-tooth design that tends to quieter running, greater strength or durability, is deserving of consideration.

*Presented to the convention of the Society of Automobile Engineers.

The system described in this paper is not new, although none of the authors of the standard gear books have deemed it worthy of more than a passing comment. It is, of course, understood that the tooth is of true involute or of octoid form, depending upon whether it is produced for a spur or bevel gear. The special feature of it is the lengthening of the addendum of the pinion tooth, with a corresponding shortening of addendum of the gear tooth—the whole depth remaining the same, as in the standard tooth.

FINDING CIRCULAR THICKNESS OF TOOTH

The addendum of the pinion tooth as further described in this paper is arbitrarily taken as 0.7 of its working depth, and 0.3 for the gear tooth for both 14½- and 20-degree pressure angle. To find the circular thickness of the tooth, at the pitch line, for these depths, multiply the circular pitch by 0.5659 for the pinion, and by 0.4341 for the gear for 14½-degree pressure angle. For 20-degree pressure angle multiply the circular pitch by 0.5927 and 0.4037, respectively, for the pinion and gear.

This is most easily seen from the rack tooth, Fig. 1, which, being straight-sided, and the sides normal to the pressure angle, requires merely the solving of the triangle for the slide *B C*, and the adding or subtracting twice that amount from the normal circular thickness, depending

Name	Symbols: Pinion	Symbols: Gear	Formulas: Pinion	Formulas: Gear
Number teeth	N_1	N_2	$N_1 = Pd \times D_1$	$N_2 = Pd \times D_2$
Diametral pitch	Pd		$Pd = \frac{N_1}{D_1} = \frac{N_2}{D_2}$	
Circular pitch	Pc		Table No. 1	
Pitch diameter in inches	D_1	D_2	$D_1 = \frac{N_1}{Pd}$	$D_2 = \frac{N_2}{Pd}$
Pitch angle	P_1	P_2	$\tan p_1 = \frac{N_1}{N_2}$	$\tan p_2 = \frac{N_2}{N_1}$
Working depth	W		$\frac{2}{Pd}$	
Addendum	A_1	A_2	$A_1 = 0.7 \times W$	$A_2 = 0.3 \times W$
Dedendum	E_1	E_2	$E_1 = A_2 + G$	$E_2 = A_1 + G$
Clearance	G		$G = Pc \times 0.05$	
Full depth	F		$F = W + G$	
One-half diameter increment	I_1	I_2	$I_1 = A_1 \times \cos p_1$	$I_2 = A_2 \times \cos p_2$
Outside diameter	O_1	O_2	$O_1 = D_1 + 2I_2$	$O_2 = D_2 + 2I_1$
Circular thickness	T_1	T_2	$T_1 = Pc \times 0.5927$	$T_2 = Pc - T_1$
Pitch cone distance	C		$C = \frac{D_1}{2 \times \sin p_1}$	
Back cone distance	B_1	B_2	$B_1 = C \times \tan p_1$	$B_2 = C \times \tan p_2$
Addendum angle	r_1	r_2	$\tan r_1 = \frac{A_1}{C}$	$\tan r_2 = \frac{A_2}{C}$
Dedendum angle	s_1	s_2	$\tan s_1 = \frac{E_1}{C}$	$\tan s_2 = \frac{E_2}{C}$
Face angle	t_1	t_2	$t_1 = p_1 + r_1$	$t_2 = p_2 + r_2$
Cutting angle	y_1	y_2	$y_1 = p_1 - s_1$	$y_2 = p_2 - s_2$
Distance from crown to pitch line	H_1	H_2	$H_1 = A_1 \times \sin p_1$	$H_2 = A_2 \times \sin p_2$
No teeth in spur gear having diameter equal to twice the back cone distance	S_1	S_2	$S_1 = 2 \times Pd \times B_1$	$S_2 = 2 \times Pd \times B_2$
Chordal thickness	I_1	I_2	Table No. 2	Table No. 2
Corrected pitch diameter	K_1	K_2	Table No. 2	Table No. 2
Angle of tool slides	×		$\tan \times = \frac{\frac{T_1}{2} + (E_1 \times \tan 20°)}{C}$	

FORMULAS FOR LONG ADDENDUM BEVEL GEARS

upon whether the given pitch depth is greater or less than the normal depth.

Let

a = Normal pitch depth;
b = Given pitch depth.
c = Difference between a and b;
$d = B - C$, Fig. 1, $= c \times$ tangent of pressure angle.

Required circular thickness equals one-half circular pitch plus or minus two times d.

The impossibility of getting accurate circular measurements necessitates the calculation of the chordal thickness and corrected pitch depth. Referring to Fig.

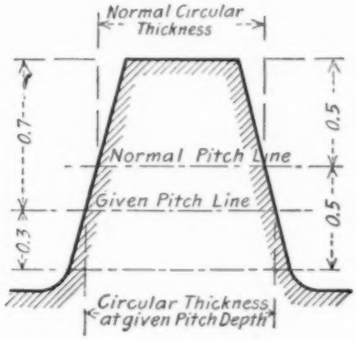


Fig. 1

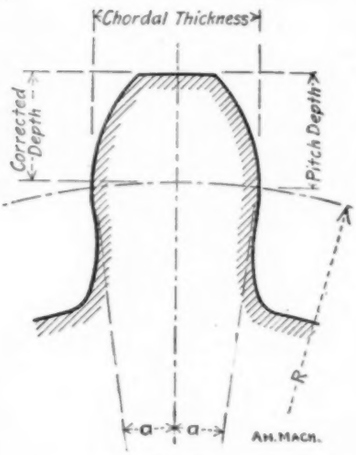


Fig. 2

SYMBOLS USED IN SPUR-GEAR FORMULAS

2, let R equal the pitch radius for spur gear or the back cone distance for a bevel gear, angle a equals

$$\frac{1}{2}\ \frac{\text{360 Degrees}}{2 \times \text{R} \times 3.1416}$$

circular thickness.

Chordal thickness equals $2 \times$ sine angle $a \times R$.

Corrected pitch depth equals versed sine angle $a \times R$ plus the given pitch depth.

I have tabulated these values for gears with as large a range of teeth numbers as the system is applicable to with advantage, in my opinion.

CHORDAL THICKNESS OF TEETH FOR SPUR GEARS 1 DIAMETRAL PITCH SPECIAL PITCH DEPTH

To obtain chordal thickness of teeth and corrected pitch depth for any diametral pitch other than 1, divide figures in table by diametral pitch required.

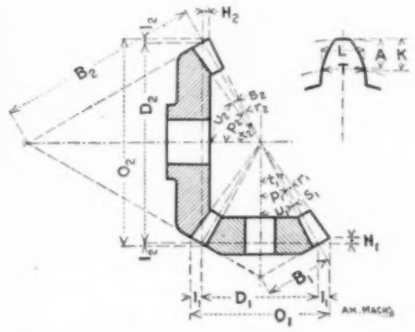


FIG. 3. SYMBOLS USED IN BEVEL-GEAR FORMULAS

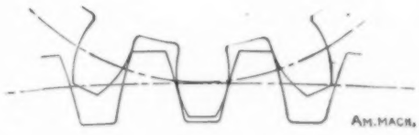


FIG. 4. STANDARD 14½-DEGREE INVOLUTE, 14-TOOTH PINION

FIG. 5. LONG-ADDENDUM 14½-DEGREE INVOLUTE, 14-TOOTH PINION

I have also arranged the formulas in the logical routine order for all necessary calculations for a pair of bevel gears of this system; symbols are as indicated in Fig. 3.

As some firms are using the metric pitch or "Module" system, the conversion table below is given for their convenience.

20 PRESSURE ANGLE—FOR PINION'S ADDENDUM—$\frac{7}{10}$ WORKING DEPTH

Number of Teeth	Chordal Thickness	Corrected Pitch Depth
12	1.8545	1.4720
13	1.8554	1.4665
14	1.8567	1.4618
15–16	1.8573	1.4559
17–18	1.8584	1.4495
19–20	1.8592	1.4442
21–22	1.8597	1.4402
23–25	1.8601	1.4361
26–29	1.8606	1.4316
30–34	1.8609	1.4272
FOR GEAR'S ADDENDUM—$\frac{6}{10}$ WORKING DEPTH		
35–41	1.2792	0.6107
42–54	1.2793	0.6085
55–79	1.2794	0.6060
80–134	1.2795	0.6040
134	1.2795	0.6030

NOTE.—For bevel gears, find chordal thickness of tooth and corrected pitch depth of gear with the same number of teeth as a spur gear having a diameter equal to twice the back cone distance.

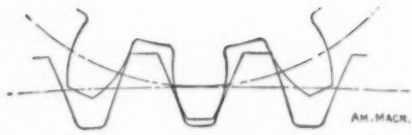


FIG. 6. STANDARD 20-DEGREE INVOLUTE, 14-TOOTH PINION

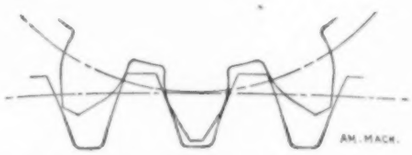


FIG. 7. LONG-ADDENDUM 20-DEGREE INVOLUTE, 14-TOOTH PINION

Diametral Pitch	Circular Pitch	Nearest Metric Pitch or "Module"	Diametral Equivalent of "Module"	Circular Pitch corresponding to Module
2¼	1.3962	11	2.309	1.3607
2½	1.2566	10	2.540	1.2370
2¾	1.1424	9	2.822	1.1133
3	1.0472	8	3.175	0.9896
3½	0.8976	7	3.628	0.8659
4	0.7854	6	4.233	0.7422
4½	0.6981	5.5	4.618	0.6803
5	0.6283	5	5.080	0.6185
5½	0.5712	4.5	5.644	0.5566
6	0.5236	4	6.350	0.4948

DIAMETRAL PITCH—STANDARD TEETH

Soft Solder

According to the *Brass World* ordinary tinner's solder is composed of half tin and half lead. A solder with a low melting point is made from two parts of tin and one part of lead. Wiping solder used by plumbers for wiping joints on lead pipe is made of two parts of lead and one part of tin. Solder made in these proportions is plastic when cooling.

Although much solder is made from scrap metals it should in order to obtain perfect uniformity be made of new metals. Pig tin and lead are placed in an iron ladle or kettle and heat is applied. As the metals melt they should be thoroughly stirred with an iron paddle. This is necessary because the lead being so much heavier than the tin is apt to fall to the bottom of the kettle. After thoroughly stirring the dross should be skimmed from the top. After this is removed it will be found that a thin film of oxide still remains which it is impossible to remove with the skimming tool. To correct this a handful of common rosin is thrown on top of the molten metal. After it has melted the scum is removed, leaving the surface of the solder perfectly clean and clear. Rosin is the best flux for soft solder when new metals are used.

Thus cleaned the solder is ready to pour. The molds are best made of cast iron as it is cheap and the solder will not stick to it as it is liable to do when brass molds are used.

Month by Month Efficiency

By H. S. Hubbell*

Suggestions for studying the real efficiency of machines or departments, to show what they are doing month by month as compared with large single-day outputs.

Dividing the machines into groups and studying the causes for delays on different work.

*Engineer, T. R. Almond Manufacturing Company.

It is month-by-month efficiency which counts. Every shop executive, from the works manager down to the foreman, knows that it is the output month after month which counts, rather than any spasmodic speeding up which may temporarily secure a large production, few realize how far the average production falls below the maximum.

It is comparatively easy to speed up the man and the machine on one or two jobs and reduce the time very materially by so doing; but, unless we are more than ordinarily careful, the month-by-month efficiency will be very much farther below this than we are apt to realize.

As an example of this, I am presenting the results of some very careful investigations made by the T. R. Almond Manufacturing Company, Ashburnham, Mass., on two types of machines used in their shops. The first group refers to a line of automatics, and the second to hand-operated machines. These records are kept by the plan known as the "surface of frequencies" as suggested by Mr. Thorndike in his "Theory of Mental and Social Measurements."

The percentage of efficiency is based on the largest day's work which was accomplished on any machines of the group, and the efficiency for the month determined by calling this 100 per cent.

Figs. 1, 2 and 3 show the automatics, and 4, 5 and 6 the hand-operated machines. The base line shows the percentage of efficiency while the vertical gives the percentage of working time during which the different efficiencies were obtained.

Analyzing the Diagrams

Beginning with Fig. 1 we find that 18 per cent. of the time the machines were running at an average of 20 per cent. efficiency, varying during this percentage of the time from 10 to 30 per cent. During 6 per cent. of the working time the efficiency was from 30 to 40 per cent., another 6 per cent. ranged from 60 to 70 per cent. efficiency, while a third 6 per cent. was from 80 to 90 per cent. efficient. For 12 per cent. of the time the efficiency varied from 40 to 50 per cent., and during a second period of the same length it ranged from 70 to 80 per cent. while 24 per cent. of the time, it was from 90 to 100 per cent. efficient. At no time during the month did the efficiency fall below 10 per cent., nor was it in the field between 50 and 60 per cent. The total average for the month was only 52 per cent.

In Fig. 2 we see an entirely different arrangement of averages, there being four distinct groups, with only 9 per cent. of the time as low as 10 to 30 per cent. and as high as 48 per cent. of the time running between 90 and 100 per cent. efficiency. It is interesting to note that there are four gaps, as there is nothing below 10 per cent., nothing between 30 and 40 per cent., between 50 and 70 per cent. or between 80 and 90 per cent.

Fig. 3 shows a summary of a large number of these diagrams, in which there are no gaps, and in which the highest efficiency is only attained a little more than 20 per cent. of the time. The total average is only 60 per cent.

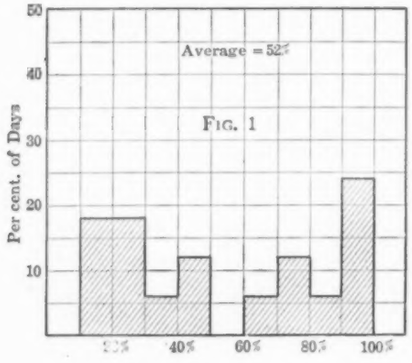


Fig. 1

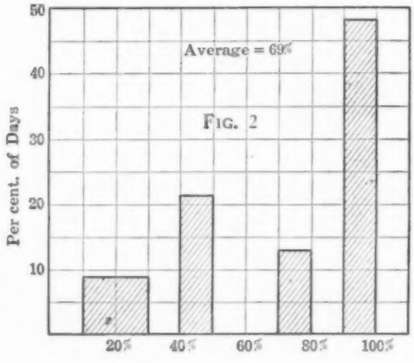


Fig. 2

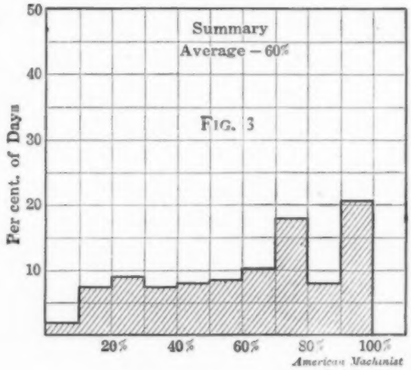


Fig. 3

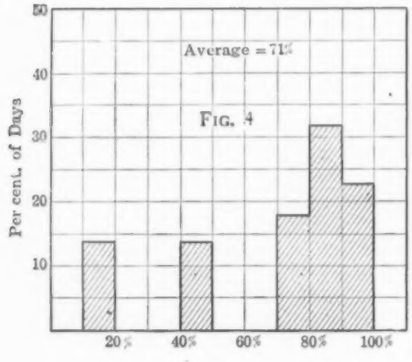


Fig. 4

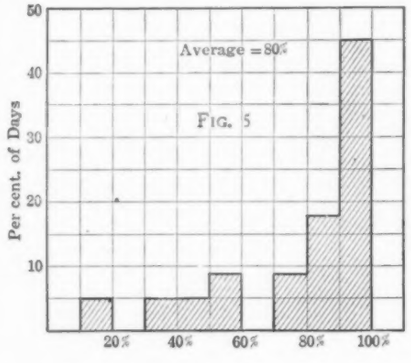


Fig. 5

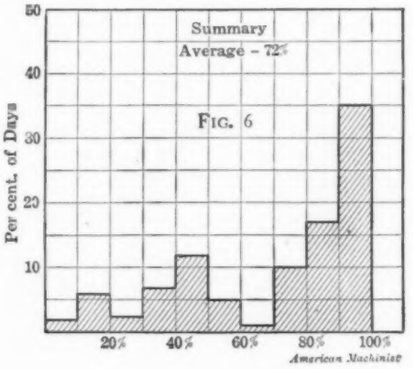


Fig. 6

Hand-operated Machines

Going to the hand-operated machines we find two interesting charts in Figs. 4 and 5. In the first the efficiency range from 10 to 20 per cent. for 14 per cent. of the time worked, and for another period of the same length an average of 40 to 50 per cent. was secured.

There is nothing more until we reach the 70 per cent. mark, which was obtained 18 per cent. of the time, while 32 per cent. of the time the efficiency ranged between 80 and 90, dropping to 23 per cent. of the time for maximum production.

Fig. 5 shows an average efficiency of 80 per cent., which is divided up into three groups, the efficiency of between 90 and 100 per cent. being maintained for 45 per cent. of the time worked.

Fig. 6 shows a summary of a large number of the charts taken on the hand-operated machine, and gives an average of 72 per cent. for this group. It is interesting in showing that the efficiency ranged between 80 and 100 per cent. for a longer period than at any given lower percentage, and in fact longer than all the others put together, as the total time occupied by the heavy end of the chart is 52 per cent. of the time worked.

These charts make an interesting study of a very vital question, and whether this method of plotting is the easiest or the most desirable, it is a line of investigation that it will pay any manufacturing plant to follow in whatever manner seems best adapted to their particular organization.

For, while phenomenal day's runs are interesting and often show possibilities never dreamed of, it is the month-by-month or year-by-year efficiency that really tells the story of the real cost of a firm's product. This is affected in many ways, and if a careful study is to be made, the stock used, the machine and its equipment, the cutting speeds and feeds, as well as the training of the operator must all be carefully considered.

And both makers and users of machines can find an opportunity for active coöperation along lines that will tend to avoid delays and will keep a machine at work as large a percentage of the time as possible.

I believe it is quite possible to materially increase the efficiency of the automatic machines by securing a more uniform quality of stock and we are now working to that end.

Special Screw Machine Attachments

By H. Buxbaum

Several attachments of German design, which, while special, are produced on a manufacturing basis.

An interesting threading process.

The firm Ludwig Loewe & Co., Berlin, Germany, has perfected for its automatic forming and turret machines a line of attachments which, in spite of the fact that they are intended for different kinds of special work, are so far standardized that they are produced upon a manufacturing basis. Their object is, first, to increase the efficiency of the automatic machines and also to make possible the equipping of a small type of machine with a special appliance which will enable the production of such pieces as, without this kind of a fixture, would necessitate larger types of machines, or extensive turret lathes, instead of the simple forming machines.

Fig. 1, for example, shows an attachment intended for long and deep cuts from the cross slide, using simple cutting tools. Without such a longitudinal turning rest work of this sort would require broad forming tools and, because of the power required for working properly with such tools, a heavier type of machine would be necessary. The longitudinal turning appliance shown, runs smoothly because of the narrow width of the tool and causes very little chattering. Beside grooving cuts which generally are made in the middle of the piece of work, and therefore can only be machined from the cross slide, there is also occasion to do turning that can be done from the tool carriage or perhaps from the turret, yet which some circumstance or other renders impracticable to perform in that manner; for example, if the cut is taper. In such cases also, this "longitudinal-turning rest" can be used with advantage.

The cross movement is actuated by the lever of the cross slide (or rest) in connection with a suitable carriage; the longitudinal movement, however, is provided by means of an operating rod which is given its longitudinal motion through a roll and lever, generally from the operating cam of the tool carriage. This rod carries on its front end a roll which enters a groove of the cross slide in order to be independent of the cross motion of the slide. The guide which produces the longitudinal movement can be swung around by an adjusting screw visible on the left, so that conical work may be turned. Naturally, an operation of this sort can be performed at the same time a drilling or boring operation is going on, for which purpose the tool carriage must carry a suitable drilling or boring tool. In order to make such double operations independent one of the other, the movement of the longitudinal turning rest is accomplished by a separate cam on the cam drum. When, however, the drive is executed in a simple manner by moving forward the longitudinal rod by means of a lug or stop on the tool carriage, these two movements are mutually dependent.

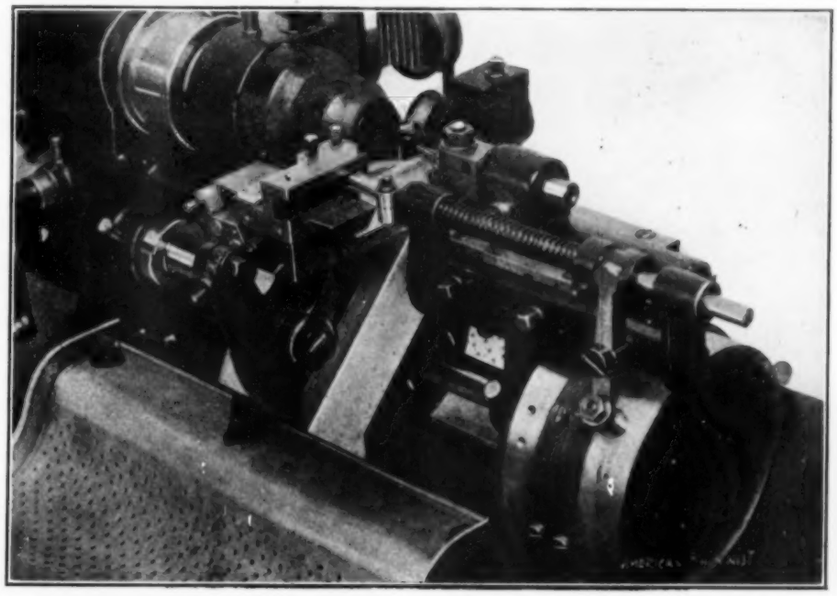


Fig. 1. Turning Device for Automatic Forming and Turret Machines

A similar construction is shown in Fig. 2, only that the lug or stop above mentioned is here placed on the turret of an automatic turret machine. Otherwise, the design in Fig. 2 resembles that in Fig. 1, being further distinguished only by the absence of the swiveling feature of the rest.

A further special fixture for the Loewe

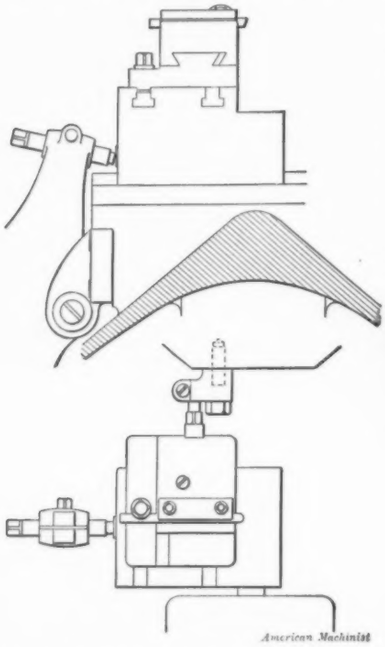


FIG. 2. APPLICATION TO AN AUTOMATIC TURRET MACHINE

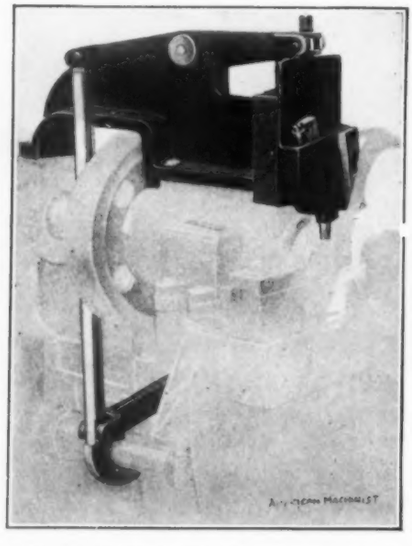


FIG. 3. APPLICATION OF "THIRD CROSS SLIDE" TO AUTOMATIC MACHINE

automatics is shown in Fig. 3, it being more particularly intended for the forming lathes (without turret). This is a "third cross slide" which moves downward and is used to make complicated pieces for whose machining the two cross slides ordinarily present do not suffice. The third cross slide can be used for grooving, burnishing, nurling, or cutting off, and is so arranged that its tool can work together with a tool on one of the other cross slides. The slide is actuated by a lever so arranged that in operating the vertical slide there is no injurious pressure on its guides.

AN INTERESTING THREADING PROCESS

Fig. 4 illustrates an attachment by which simple forming lathes can be used under proper cutting conditions for threading purposes. This attachment operates upon the differential principle and employs a thread-cutting head with automatically opening jaws. The threading head is driven from the work spindle by means of double gearing in such manner that it turns in the same direction

FIG. 5. THREADING ATTACHMENT WITH SOLID DIE

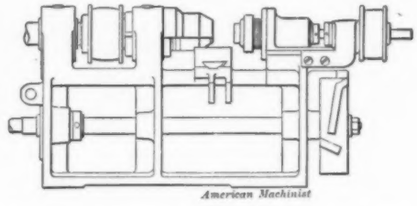


FIG. 6. MACHINE WITH BELT-DRIVEN DIE SPINDLE

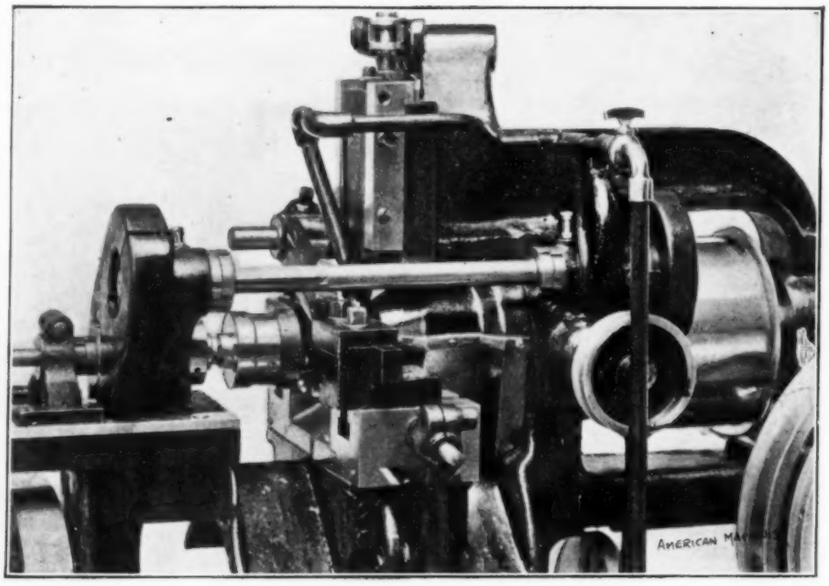


FIG. 4. THREADING ATTACHMENT IN OPERATION

as the work spindle, but at slower speed, the difference between the two speeds adapting it to thread-cutting purposes. As soon as the end of the thread is reached, the jaws of the die are opened automatically by means of the stop collars clearly shown in Fig. 5, which are adjustable on the spindle of the threading head. Then the head, without damage to the thread, is quickly withdrawn by the proper cam on the drum.

The attachment is also made for the use of solid dies, taps, however, not being considered, since no tool is provided for drilling the hole. When using solid dies the direction of rotation is dependent on the fact that the finished screw must be withdrawn from the die which is unnecessary where self-opening dies are employed. Since, when a right-hand thread has been cut, it can be gotten out of the die only by turning the screw to the left, the work spindle, when such screws are to be made, always runs left hand (the reverse of a lathe).

The direction of rotation of the die is the same as the work; its speed is greater, so that the die outruns the work spindle, and the cutting speed is equal to the difference of their respective rotary speeds.

If the thread is now cut, the die is brought to rest by means of a coupling in the fixture, and is so held that it does not revolve, but can move axially. The work spindle continuing to turn in a left-hand direction, therefore, screws the work out of the die and presses the latter back. In cutting left-hand threads the operations are *vice versa*: The work spindle runs toward the right (like a lathe) and the die in the same direction, but at greater speed.

Fig. 6 shows such an arrangement, yet in this case the threading appliance is not driven by gearing from the work spindle, but by a special belt pulley from the overhead countershaft. This design is especially adapted to small models. In general the method of operation is the same as described.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Two Useful Tools

The machining of the ball joint on dry pipes and steam pipes has always been a difficult and expensive operation. Various tools have been designed for the purpose, but have, as a rule, proved expensive or inefficient. The tool shown in the cut has proved satisfactory from the standpoints of first cost, maintenance and accuracy. It consists of a cast-steel body with inserted blades of high-speed steel and a Morse taper shank of tool steel.

Another operation for which many tools have been designed is that of cutting holes for flues in a sheet of steel. The tool shown has been run in tests in competition with many other designs, and has invariably cut more holes per hour than any of the others.

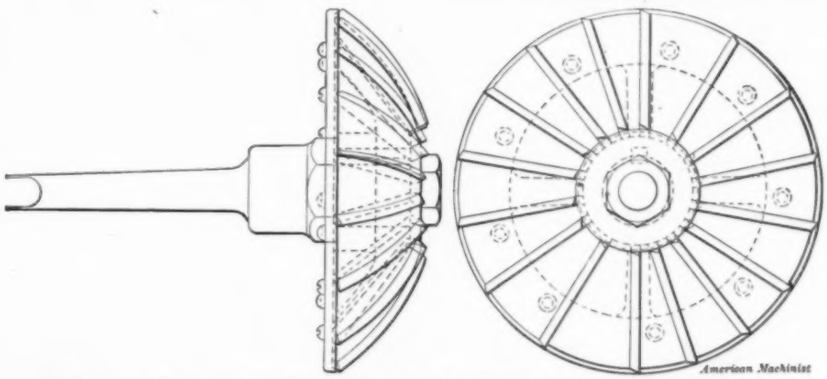


FIG. 1. BALL-JOINT REAMER FOR DRY-PIPE AND STEAM-PIPE WORK

Both of these tools have been adopted as standard by a large shop.

New York. C. J. MORRISON.

What to Put in the Tool Room

It is a much discussed question, though the discussion may seldom appear in print, as to what should be put in the tool room. An easy solution is to say that everything that can be carried in the hands should be placed therein. Whenever this is tried it is found difficult to get hold of everything movable with the hands. Lathe and planer tools, knees, angles, stop pins, lathe face plates and center rests seem to be a part of the machine on which they are used, and prove difficult to place in the tool room. The tap that has been found to be a "quarter of a thousandth large," and that just makes an easy fit for a lot of screws, will be found reposing in someone's tool chest along with a pet diamond-point tool that has the stamp of another shop on it, and the scraper that came from the shop before that.

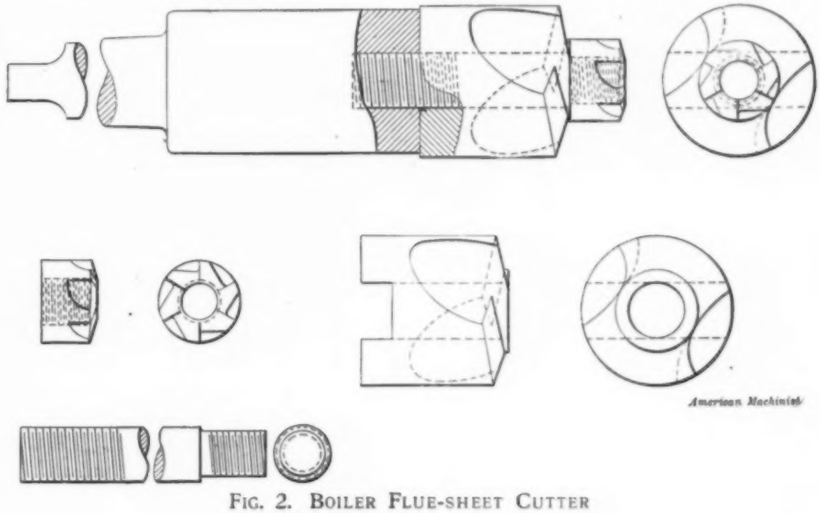


FIG. 2. BOILER FLUE-SHEET CUTTER

The best men in the shop are apt to be the worst offenders. They are the most notional; if they get an idea that a certain file is the best one they ever used, they will cling to it as long as a violinist will to a frayed "G" string.

No great harm is done in this way, in a small shop, unless the man who has these odds and ends stored away is sick or leaves. In a large shop where the same work is likely to be given to men in different sections, the situation becomes awkward, and such shops, in self-defense, have to hold a tighter rein.

This does not, however, apply to planer fixtures. They are usually too large to be carried away by the workmen, their kit rarely having anything more than a few shims picked up at odd minutes. These tools, as well as cutting tools, chucks and the like, may well be numbered to correspond with the machine on which they are intended to be used and left at the machine.

Still another matter, in the same connection, is in the case of speed lathes, arbor presses, sensitive drills and small machines not regularly used by a steady operative, but run at odd times by anyone who has need of them.

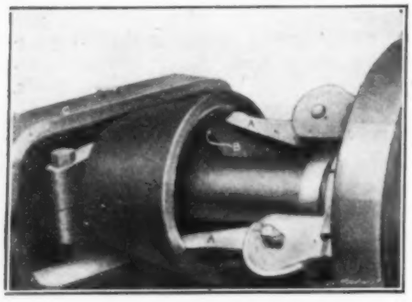
These machines, in the average shop, are left to the uncertain care of some laborer or sweeper whose efforts do not go beyond keeping them clean.

It appears to me that all of these tools, portable or otherwise, that are not used exclusively by one operative, should come under the care of the tool-room man, and that he should be capable of repairing and adjusting all of them. Then if he is held responsible for their condition, no matter where they are, and if he knows where they are at least as often as once a week, things will go better and more smoothly than they would otherwise. The time lost on account of hunting up proper tools, and especially on account of the tools being in improper condition when found, is enough to make the difference between success and failure in many a shop.

Worcester, Mass. ENTROPY.

An Internal Clutch Spool

The halftone shows an internal clutch spool which is a "new one on me." It is a homemade one applied to a hollow-spindle lathe. The object was to use push-out chucks in the lathe. An ordinary "closer" was threaded to fit the nose of the spindle. Owing to certain conditions it was necessary to have the lever *C* close the chuck when pulled by the operator from his position in front of the



AN INTERNAL CLUTCH SPOOL

lathe and to open when pushed back. This the ordinary external cone would not do, so the spool was made with an internal cone bearing on the fingers *A*, with a plain cylindrical device or rest at *B*.

New York. A. D. E.

Roller Tool for Polishing Piston Rods

The accompanying cut shows a tool designed and used in the Chicago & Northwestern Railway shops, for putting a finish on piston rods after they have been rough turned, and which gives a hard, high polish with one passage, without the necessity of the usual filing and block polishing.

The device is clamped to the tool block; the rollers adjusted to the piston; the carriage feed thrown in and the tool allowed to travel the full length of the piston rod.

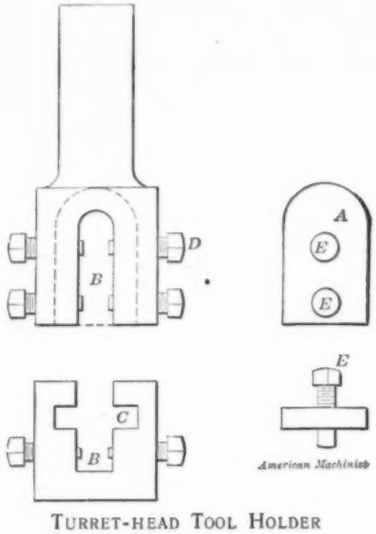
The general design is similar to a lathe-steady rest and the hardened-steel rolls run on rollers and also have a set of steel balls to take the side thrust, as shown.

CHARLES MARKEL,
Shop Foreman.

Clinton, Iowa.

A New Turret Head Tool Holder

The illustration shows a new turret-head tool holder, designed for ½-inch steel, which I find to be a very handy tool.



TURRET-HEAD TOOL HOLDER

The slot *B* is ⅝ inch wide, which will give the operator ⅛ inch play to swing his tool past the setscrews *D*. The sliding clamp *A* slides into slot *C*. The two setscrews *E* hold the tool and lock the clamp in a solid position.

When the tool is dull, the screws *E* are loosened and slide *A* removed; this gives the operator an opportunity to clean chips out. This tool holder is an inexpensive tool and is made of a piece of two-inch square machine steel with shank turned on. The slot *B* and slot *C* are machined by end mills. Piece *A* is tool steel. The screws *D* and *E* are 5/16-inch setscrews.

Rahway, N. J. FRED PETERS.

Fixture for Milling a Bevel

Fig. 1 shows three vise jaws arranged for milling a bevel.

After being square milled on one edge in this fixture, a number being milled at a time, the bevel on the opposite edge is then milled on four pieces at a time, with the two angular cutters as shown in illustration.

All the parts are hardened and ground; the three holes in the jaws being lapped to size.

The jaws work on the three pins *D;* those pins hold the central jaw in position and the other two jaws parallel with each other.

The three pins *D* are a driving fit in

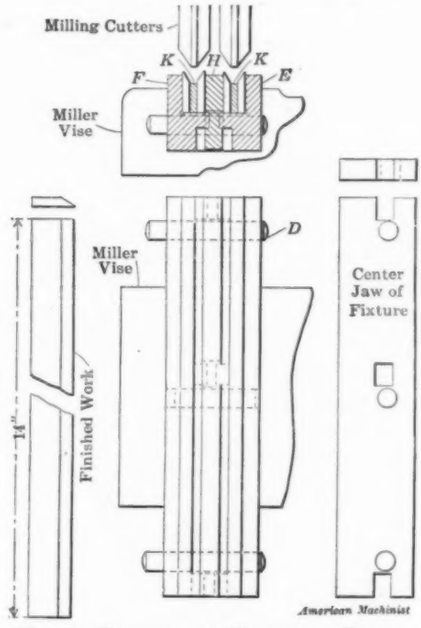


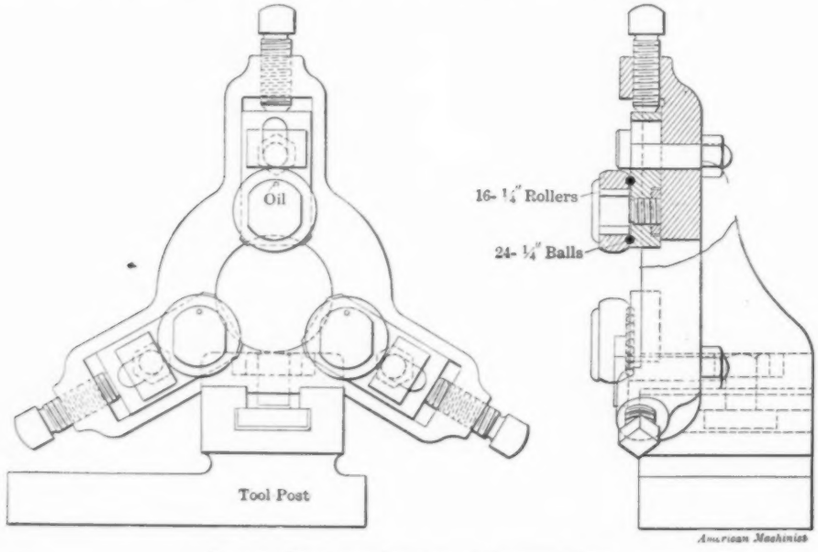
FIG. 1. FIXTURE FOR MILLING A BEVEL

jaw *E*, and a sliding fit in the other two jaws.

On the jaws *E* and *F* are three projections which are a free fit in the central jaw *H*. These projections furnish a wide range to open the vise without the work falling out of it and also allow more room at the bottom of the vise for any chips that may accumulate. *K K* are two hardened spacers which separate the work in the vise.

This fixture is used for several similar jobs, and also for a number of jobs of cross milling on thin flat work.

Detroit, Mich. DAVID MELVILLE.



ROLLER TOOL FOR POLISHING PISTON RODS

An Eccentric Jig Boring Tool Holder

Anyone doing any amount of accurate boring, such as is required on jigs, will be able to appreciate and welcome an efficient boring tool, to displace the clumsy boring bar generally used.

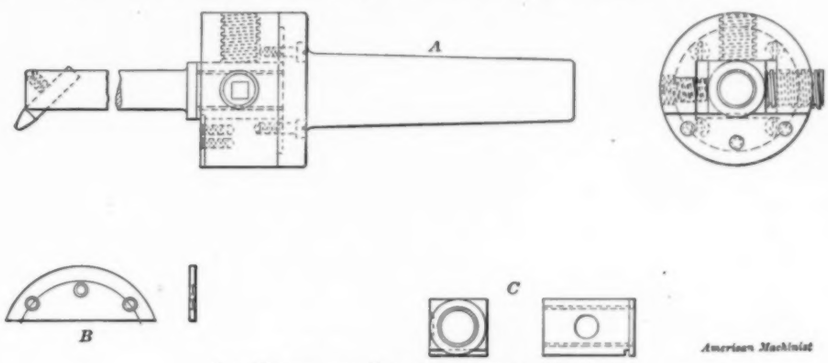
The illustration shows a boring-tool holder, designed by me, which has proved very successful. The body and shank were made of mild steel, carbonized, hardened and ground.

The shaft *A* may be made any size convenient to the user. The body is made independent of the shank and fastened by means of the four setscrews, thus enabling the rectangular slot, which makes the fitting for the slide, to be cut easier.

A segment of the face of the body is shaped away to receive the plate *B*, which is screwed down by three cone-headed screws, engaging with the slot cut in the slide *C*; this method being as efficient and less trouble than making a taper slide. The adjustment of the feed is made by the square-threaded screw and is clamped, when set, by means of a similar screw; the spring holding the slide steady when loosened. When in use the tool is absolutely rigid and does not chatter or shift.

A micrometer adjustment may be made around the screw, thus making the manipulation of the tool as simple and easy as if one was boring with an ordinary tool in the tool post.

Coventry, England. G. C.

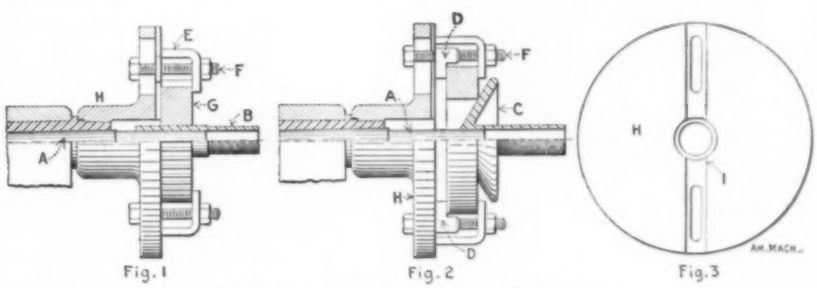


AN ECCENTRIC JIG-BORING TOOL HOLDER

An Economical System of Chucking

Having a large number of hardened gears to be chucked for internal grinding, I adopted a system of chucking herein described, which proved to be a very satisfactory and time-saving way of handling them. The gears being cut from the hole, they ought to be chucked from the hole, in order to produce a perfect gear, and I found this system of chucking to produce accurate results, by actual test.

Referring to Fig. 1, the cast-iron sleeve *B* was made; one end of it was turned down and nurled for a hand grip, the other end was turned and ground to fit the gear. This part was 3½ inches long and was tapered 0.005 inch, to overcome the variation in the hole of the gear caused by contraction in hardening. The sleeve had through it a 1-inch hole; the head spindle of the internal grinder having a tapered hole, the stud *A* was made of tool steel, hardened and ground all over and the taper end made to fit the head spindle. The other end was ground straight to fit the sleeve *B*.



AN ECONOMICAL SYSTEM OF CHUCKING

The operation is as follows:

Put the sleeve *B* into the gear *G*, and the stud *A* into the head spindle; mount the gear *G* and the sleeve *B* on the stud *A*, clamp the gear *G* to the face plate *H* with the clamps *E*; pull out sleeve *B*, then knock out stud *A*, and you have the gear chucked perfectly.

This system of clamping the gear to the face plate is nothing new, but the method of doing it quickly and perfectly true is a time saver, as this way of handling them requires but an instant. In many shops you will find the indicator employed, mounted on some sort of tool post, and the gear moved until the indicator proves it centrally set; but with this arrangement you need no indicator; you don't have to move the gear to get it true. This operation can be performed while one is thinking about setting the indicator.

This same method can be successfully employed in grinding hardened rings internally, as shown in Fig. 2. Turn the bush *C*, the angle being about 60 degrees. Bore it out 1 inch to fit stud *A*, put stud *A* in the head spindle, hold the ring against the face plate and mount bush *C* on stud *A*. This will throw the ring centrally. Clamp the ring to the face plate, pull off bush *C*, knock out stud *A* and ring is chucked true, ready for grinding.

Bush *C* was made 6 inches in diameter, one end was turned down and nurled for a hand grip. The angled end was hollowed out as shown, to reduce the weight and make it easy to handle. It was made of machine steel, carbonized and hardened, and will do for any sized ring from 1¼- to 5¾-inch bore.

Slot *I*, Fig. 3, 1 inch wide by ¼ inch deep, was milled straight across face plate *H*. The collars on the clamp bolts *F* were milled off to fit this slot, then the slots shown were milled through the face plate to receive the clamp bolts. With this arrangement, various sizes of rings can be handled; you simply slide the clamp bolts to their respective positions and tighten.

Stepped blocks *D* will be found very handy when grinding rings that have a larger bore than the face plate. The blocks *D* are slipped over clamp bolts *F*, between the plate and the ring. This allows the grinding wheel to clear the face plate.

FERDINAND HOHNHORST,
Foreman Grinding Department,
American Tool Works Company.
Cincinnati, Ohio.

Variation in Standard Sizes of Nuts

Variation in standard sizes, by different manufacturers, has been the cause of much comment.

Dealing with one phase of the subject, viz., nuts, a test of a recent delivery gave quite erratic results. Of course, in the production of commercial articles competition demands "full steam ahead" but it should not demand it, if we thereby sacrifice uniform quality.

The cause of the variation of size in nuts is brought about by keeping the taps in active life after they have worn below size. There is not much cause for complaint with nuts, say 0.001 inch above size, for they will always take the screw,

but a decided objection to the same amount below size.

For any shop where interchangeable parts are made, a periodic gage test is essential, otherwise the gage system would fail. In like manner, nut taps must be subjected to a frequent test, relative to pitch diameter, if standard sizes are to be maintained.

For reference to the true facing of commercial nuts, there is still need for improvement. The suggestion of the correspondent to have the nut slack enough on the screw to permit of face contact adjustment, may be all right for certain work, but for fine machine-tool work the method is wrong. ANDREW WEBSTER.

Glasgow, Scotland.

A Clamp Die and a Nurling Attachment

The illustrations show a clamp die used for flaring tubing and a nurling attachment.

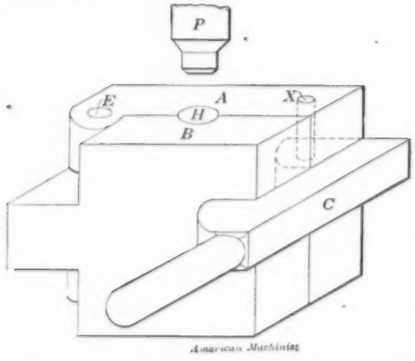


FIG. 1. CLAMP DIE FOR FLARING TUBES

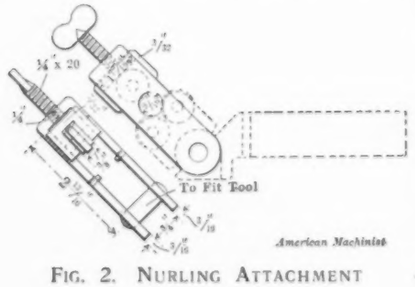


FIG. 2. NURLING ATTACHMENT

Fig. 1 is the die, consisting of parts *A* and *B*, which are hinged together at *E*. Part *A* is fastened to the die bed, while the part *B* swings to allow the work to be placed in the hole *H*, where it is firmly held by the cam lever *C*. The shape of the punch is shown at *P*. The tube, of course, is left projecting the proper distance above the die at *H*.

Fig. 2 shows the nurling attachment, which is a good arrangement for nurling small work. Put one end of the work in the lathe chuck and start the nurl close to the chuck and feed left-handed. With this attachment you can nurl a piece the length of your carriage travel.

Springfield, Mass. C. H. WILCOX.

Nut Tapping Fixture for the Driller

Having several thousand 1⅛-inch square nuts to be tapped, with a 13/16-inch 24-thread tap, I decided to tap them in the driller, using a tapper tap, with a long shank, and the fixture shown in Fig. 1, clamped to the driller table, the slot in which would hold three of the nuts.

The threaded portion of tap was run entirely through these three nuts, and then another lot of three were placed in the block and the operation repeated until shank of tap was nearly full, then

FIG. 1

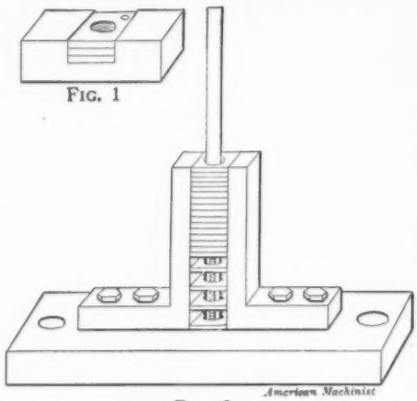


FIG. 2
NUT-TAPPING FIXTURE FOR DRILLER

the tap was taken from the chuck and the nuts removed.

This method did not work very well, as the tap, in passing through the first nut, would throw a bur, slightly separating it from the second, and on continuing through would force chips into this space, which would very often jam the tap so tightly that it would break or else stop the machine.

I then made the fixture shown in Fig. 2, which worked satisfactorily. In operating, I would place a nut in the fixture, push it back against a stop pin, bring tap down and let it run in about six threads, then lift the tap up far enough to insert another nut, the tap revolving all the time—and repeat this operation until the tap was full.

There is no danger of the nuts jamming the tap, as the driller table is set at such a hight that the threaded portion of the tap cannot be raised as high as the top of the uprights on fixture.

E. A. ERMOLD.

Superintendent Electro Dental Manufacturing Company,

Philadelphia, Penn.

Changing a Hand Feed Turret Head to Power

Being employed in a small repair and jobbing shop where the shop equipment consisted of three lathes, two drill presses and an emery wheel, we often had to do considerable hard hand work.

One of our lathes was fitted with a hand-feed turret head, and it frequently became very tiresome to feed it by hand, so I made the turret into a power feed, with automatic knock-off, as shown in illustration.

At *A* is a bracket fastened to the head of the turret with four screws. *B* is a worm gear keyed to the hand-feed shaft of the turret. *C* is a worm shaft which carries bevel gear *D*, which meshes with bevel gear *E*. *F* is a gear bracket which carries bevel gear *E* and the two spur gears *G* and *H*. It is fastened to bracket *A* with two screws.

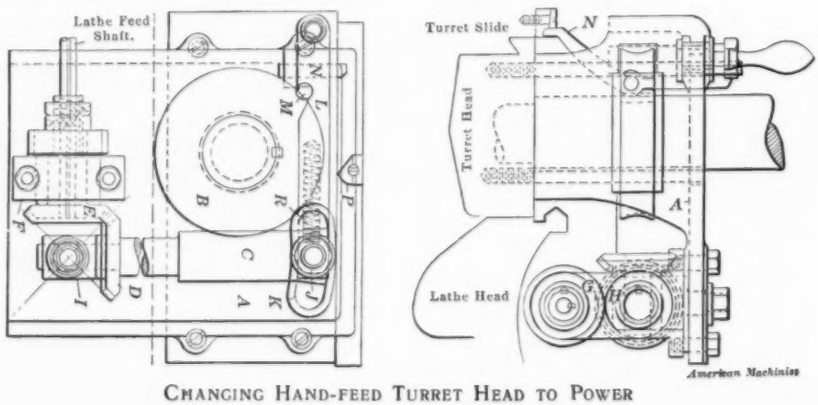
Spur gear *H* is keyed on a sleeve, and the sleeve is keyed with a sliding fit on the lathe feed shaft and allows the turret head to be placed at any point on the lathe head.

The worm-shaft bearing at *I* has a working fit in bracket *A*; the bearing at *J* has a block that slides in slot *K* on bracket *A*, which allows worm to be disengaged from worm gear by lifting lever *L* off of pin *M*. Block *P* on turret slide engages lever *N* which lifts lever *L* off of pin *M*, and spring *R* forces worm out of engagement with worm gear and stops the feed.

The worm gear for this job was hobbed on the lathe, and the spur gears were also cut on it. The two bevel gears were saved from the scrap heap, so that the device costs very little, and saves a lot of hard pushing, by hand.

ALBERT JACKSON.

Los Angeles, Cal.



CHANGING HAND-FEED TURRET HEAD TO POWER

Truing Buttons on the Miller

I have been much interested in descriptions of indicators in the AMERICAN MACHINIST for truing buttons on the miller. I use the Lindholm rotary indicator and true up by the center in the button.

A description of this indicator was published some time ago, and after three years' trial, I see nothing lacking in it for speed and accuracy.

I am at present using it right along and do not use the button except occasionally. In most cases I simply lay out the holes with the hight gage and then, with the much abused center punch, an indentation is made at the intersecting lines.

A man who is skilled in the business can, with the punch and the aid of an eye glass, produce good work and a lot of it. Of course, this center punch must not be ground free hand, but on a bench grinder.

If some of the doubtful ones from across the water will only try this out, their troubles will fade away.

Jackson, Mich. F. J. GLASHEEN.

Turret Tool for Lathe

The accompanying line cut shows a turret tool which I designed and used on a lathe in the place of the ordinary tool post. With this simple tool you can use the graduations on the cross feed or stops

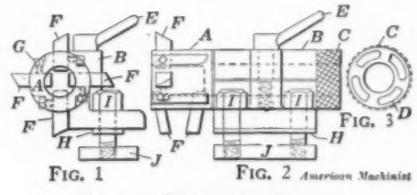


FIG. 1 FIG. 2 FIG. 3 American Machinist

TURRET TOOL FOR LATHE

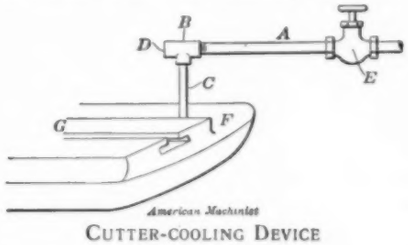
to set the cut by. Every time the tool is turned around it comes absolutely in the same place.

It was made for a job where the outside diameter was to be turned to size and the sides faced to a certain thickness, which I did with the straddle tools. It increased the output of the lathe about 300 per cent. over the ordinary method. The tool is simply a revolving head *A* with a spindle turned down and passing through the fixture *B*, and a nurled collar *C*, which is shown in Fig. 3, which also shows the ratchet steps *D* on the inside face. A hardened pin is set in the body *B*, with a spring behind it, which holds the tool from turning in the direction of the work but does not prevent its turning toward the operator. The handle *E* is used to lock the turret from turning in either direction. The tools are held in the head by the set-screws *G*. The tongue *H* goes in the tool-post slot on the lathe and is held by the cap screws *I* and the plate *J*. This tool can be used on many jobs other than the one it was intended for and the capacity of the machine largely increased.

Syracuse, N. Y. F. D. THOMAS.

High Speed Milling with Carbon Steel Cutters

The line cut shows a cutter-cooling device which has just been applied, by the Utica Drop Forge and Tool Company, Utica, New York, to all of its Lincoln millers. It consist of a ¼-inch pipe *A* connecting with the air pressure, the ¼-inch T *B*, and the ¼-inch pipe *C* which rests in the channel *F* around the table *G* of the miller. About a pint of lubricant is put in the channel. The opening *D* is about 8 inches from the face of the cutter. The air pressure used is 12 pounds per square inch. When the valve *E* is opened the air rushing through the T *B* sucks up the lubricant (soda water) from the channel *F*, atomizes it and blows it against the face of the cutter in the form of an intensely cold mist.



CUTTER-COOLING DEVICE

The cutters are made of carbon steel and are run at 60 feet peripheral speed per minute. They stand up from 40 to 60 hours before it is necessary to grind them and the work has a very good surface. One of the principal benefits is that the floor around the machines is perfectly dry as the mist has not body enough to carry beyond the confines of the miller tables. The fine mist seems to find every part of the cutting edges of the formed cutter but there is none of the sloppiness one finds in the ordinary Lincoln milling department.

New York. D. I. X.

Liquid Ink Eraser

A valuable formula for an erasing fluid which will successfully remove india ink from tracing cloth is given below. I supposed that every engineering office was in possession of this information, but judging from several articles appearing in the AMERICAN MACHINIST recently there must be some who do not have it.

The following ingredients by weight: Gum camphor, ½ part; oxalic acid, ½ part; glycerin, 2 parts; grain alcohol, 4 parts. Apply with soft, clean cloth or cotton waste, and work from the extremities inward.

It will require some little practice to make a neat, clean erasure, but it can be done, and in many cases saves a great deal of time, and what is more valuable still, does not injure the tracing cloth as a mechanical eraser does.

Cincinnati, Ohio. A. M. T.

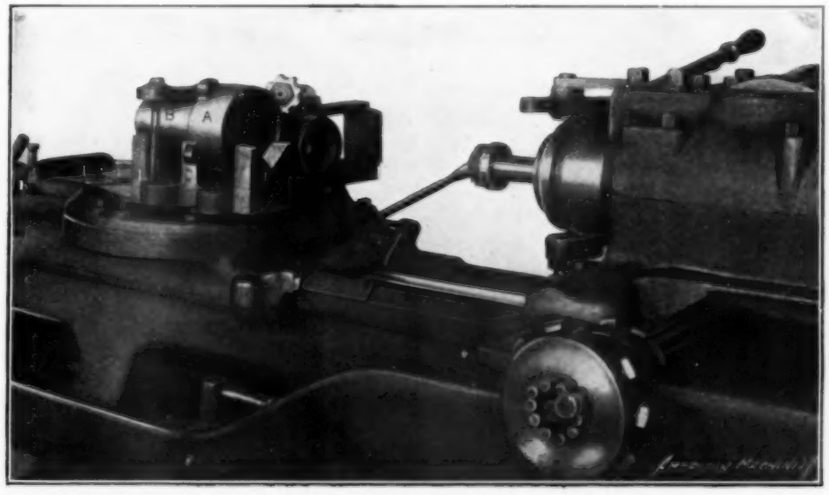
A Flat Turret Lathe Used as a Horizontal Boring Mill

I have seen the flat turret lathe used for many jobs, from slotting square holes in wrenches to twisting flat stock, but the halftone shows a stunt new to me, done in the shops of the Lamb Knitting Machine Company, Chicopee Falls, Mass.

The castings *A* had a number of operations to be performed on both ends of them. These operations included turning, boring, reaming, tapping and facing. The bodies of the castings were first turned at *B* in the flat turret lathe, using the tools in the usual way.

The part *B* was then used as a locating point for all subsequent operations. For these operations the tools were removed from the turret and suitable fixtures were located on the turret in place of them. With the work clamped in the fixtures and the tools held in the spindle, the job was turned out in record time.

New York. E. A. DIXIE.

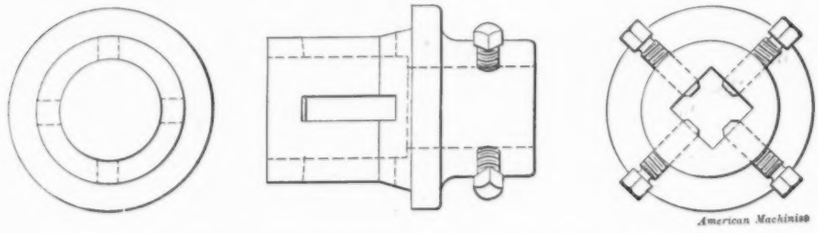


A FLAT TURRET LATHE USED AS A BORING MILL

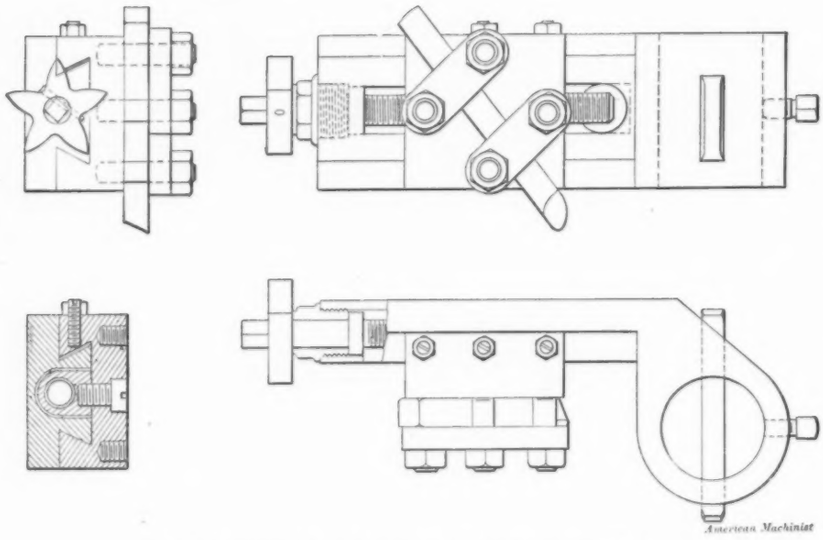
Three Useful Attachments

The line cuts show three very useful homemade attachments. The chuck for holding taps in bolt-cutter head is made to fit in the die head and held from turning by two blank dies, which have a slight draw to hold the chuck solid in the head.

The other end of this chuck is squared out 1¼ inches and has four ½-inch set-screws for holding any-sized tap up to 1¼ inches. The work to be tapped is held in bolt-cutter vise.



CHUCK FOR HOLDING TAPS IN BOLT CUTTER



TRUCK-WHEEL HUB FACER ON WHEEL-BORING MILL

PIPE-THREADING ATTACHMENT FOR BOLT CUTTER

The truck-wheel hub facer is held in place on the old-style boring-mill bar, by a key, as shown. This attachment is placed on boring-mill bar after the wheel has been bored, and a ¾-inch square tool is held in place by the four ⅝-inch blank dies which drive the chuck. The other end of this holder is squared out to hold a 3-inch pipe die, and bushings are provided to hold other dies down to ¼ inch. This attachment is simple and quickly attached to bolt-cutter head and will soon pay for itself in any shop.

Clinton, Iowa. CHARLES MARKEL.

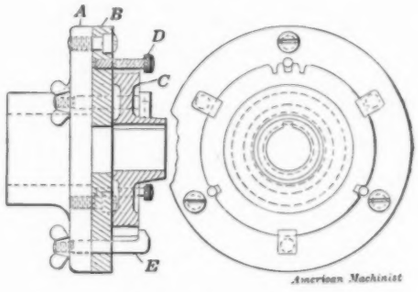
The third illustration shows a pipe-threading attachment to be used on bolt cutter and does good work. This chuck is held in bolt-cutter head by the two studs and plates. The up-and-down-adjustment is made by the usual movement of bar, and the facing feed to tool is provided by the small angle iron bolted to the boring-mill table, which strikes the star on end of screw of tool holder with every revolution of the table.

Temporary Fixture for Grinding Gears

The line cut illustrates a plain temporary fixture used in connection with the grinding of gears similar to the one shown clamped in the fixture. The fixture was employed while experimenting upon a number of gears made of 30 per cent. carbon steel and case-hardened 1/32 inch deep.

In the description of the fixture *A* is the grinder faceplate, to which is fastened the plate *B*.

In this plate three holes are carefully bored equidistant and at a radius, to accommodate the gear *C*, and the three locating pins *D*. In the use of this temporary fixture three sets of hardened and ground pins are used, varying in size from 0.228 inch to 0.230 inch, the size of these pins being taken from the thickness of the tooth at the pitch line, plus ⅛ or ⅛ of this distance, which in the location of the pins, takes care of any deflection in the teeth caused in the hardening process. That part of the pin *D*, contained in *B*, is of one size, and a light wringing fit. *B*, being clamped in position, a set of pins are inserted and carefully indicated. The faceplate of the grinder is brought to a position with one of the pins on top, this pin is removed and the gear *C*, positioned over the two lower pins, the top pin is then replaced.



TEMPORARY FIXTURES FOR GRINDING GEARS

If the gear *C*, has no lost motion it is clamped to *B*, by the three hook bolts *E* passing through *A* and *B*. If any play or lost motion is found in *C*, a larger set of pins are substituted and the hole in *C* ground to size, after which they are positioned on a fixture and allowed to revolve in mesh for a time. Should any high spots show on the teeth they are stoned down.

Detroit, Mich. R. BURTON.

In 1910 there were received at the Patent Office in Washington, 63,293 applications for mechanical patents, 1155 for design patents, 181 for reissues of patents, 6843 for registration of trade marks. Of these applications 35,807 patents were issued.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Making Tracing Cloth Bite

Making tracing cloth "bite" is certainly a problem that often vexes the soul of the draftsman. I remember one roll of cloth that was so oily that no amount of chalking, rubbing or any of the usual or unusual methods had any apparent effect upon it. After many trials we gave it up as a bad job and a defective product.

Chalking, no doubt, wears off in a short while; but it has been my experience that after a thorough first chalking, it is necessary only to rub the drawing off with a dry cloth or chamois on succeeding days. In case the drawing is a large one requiring several weeks' work, I have put on new chalk about once a week.

What to use as chalk is a source of experimentation with every draftsman. Chalk, either powdered or scraped from a stick, is, no doubt, the ordinary and probably best wherewithall. I have used talcum powder, or even flour at a pinch, but I do not recommend the latter. Some draftsmen claim that simply to rub with a dry cloth is sufficient, and supporters of the scheme of using a clean piece of blotting paper are not infrequent. Soapstone, powdered or scraped from the stick, is excellent.

There probably are as many idiosyncrasies over this operation, which is as troublesome and mussy as it is simple, as there are over any problem that we may run against.

GEORGE H. POWELL.

Philadelphia, Penn.

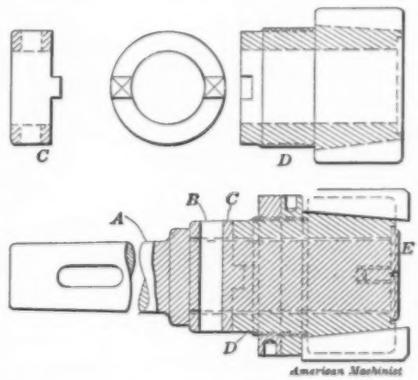
Machining Cylinders on Boring Machines

On page 309, L. E. Middleton describes an adjustable reamer used for finishing cylinders on a boring machine. This method of machining cylinders, where the work is held stationary, and the cutter revolves, appears to be coming more and more into use, and has, in some cases, displaced boring and turning mills, and lathes on this class of work.

The advantages gained by the use of cylinder-boring machines are especially noticeable where a number of cylinders are cast together, as then it frequently happens that two or more cylinders can be machined simultaneously, thus materially reducing the machining time, and cost.

The method adopted by Mr. Middleton for truing up the reamer when the boring-machine spindle does not run true, appears somewhat tedious. The blades are packed with paper, and tested with an indicator until they run true. This would be all right on a reamer where the bottom of the blade slots were parallel, but seems useless work where they are inclined, and provision made for adjustment. In the latter case would not the best method be to adjust the blades a little over size, and then mount a small portable grinder on the machine table, and grind them in position? This would insure true running.

But to me, the idea of taking the trouble to correct inaccuracies in the boring-machine spindle in the way mentioned seems labor wasted. As a finishing reamer has only a few thousandths of an inch to take off, it will easily follow the existing hole. Then, why not use a floating reamer? The tool holes on boring mills and turret lathes are never dead true with the spindle, and floating-reamer holders are used to overcome this defect. If they work satisfactorily when the work is revolving and the tool stationary, there seems no reason why the same results should not obtain when the tool revolves and the work is stationary.



FLOATING REAMER FOR MACHINING CYLINDERS

The illustration shows a type of floating reamer which has given satisfaction on this class of work. It will be noticed that this reamer does not float from a point. The shank is held solid in the machine spindle and only the head floats. This is an advantage when using heavy reamers on horizontal spindles where the weight might be a consideration.

Turning to the illustration *A*, the shank of the reamer is drilled as shown for pin *B*, which prevents collar *C* from turning. Collar *C* is bored for clearance, and has a tongue fitting the slot in shell *D*, carrying the blades. Shell *D* is also bored for clearance. Washer *E* keeps the whole arrangement in position.

It will be seen that collar *C* can move, we will say, in a vertical direction, and that shell *D* is free to move in a horizontal direction. From a combination of these two movements any position can be assumed by the reamer head.

Coventry, Eng. T. BARTON.

The Suggestion Box

I have read the articles by B. W. Church, page 266, and F. B. Jacobsen page 600, on the above subject. It has been a subject of much interest to me for many years for it is now over twenty-five years since I received my first reward for a suggestion which was considered to be of some value. It will readily be understood how glad I was to receive the thanks and the reward from my employer, as at that time I was young and wished to make my way in the shop and I felt that I had made an impression that augured well for my future. I merely mention all this by way of encouragement to others to try and do their best, because in the long run the man who *thinks* is the one who best serves both himself and his employer. But to come to the point; there is more in the suggester as proposed by B. W. Church than F. B. Jacobsen sees, and the idea is in my opinion good and worthy of consideration. My own recent experiences verifies, to some extent, the value of the suggester. The firm by whom I am at present employed has the suggestion scheme in the works, but only the men are allowed to participate in the rewards. A short time since it so happened that two individuals were both quietly working out a problem which had claimed the attention of a number of others for a long time, and strange to say the problem was solved by more than one of them within a day or so of each other.

It is here that I wish to show that it is possible for the idea of B. W. Church to become practicable. The two persons referred to above both had faith enough in me to ask me what I thought on the matter and I gladly offered my opinion with the result (for which I claim no credit) that it was seen by one of them how the job might be done, and in the

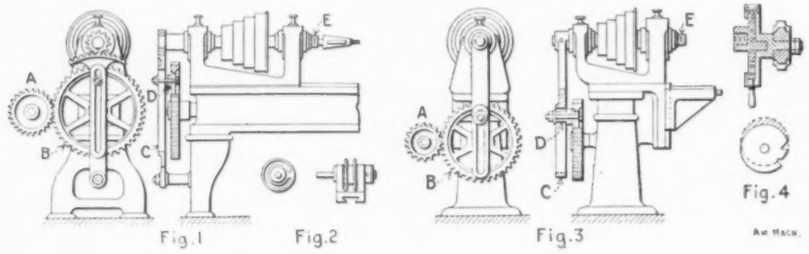
case of the other I am glad to say that he had solved the matter for himself and had found the same means to the end.

I believe the idea of either the suggester or the suggestion box is a good thing both for employer and employed, but I should like to say that I have known of foremen who have discouraged those who have worked under them by making little of a suggestion. This is a matter which should be carefully guarded against by the management, as unless the men have the assurance that their thoughts will have a fair consideration the whole scheme will fail.

Birmingham, England. W. SMITH.

A Homemade Machine for Grinding Cocks

On page 881, Volume 33, Part 2, of the AMERICAN MACHINIST, B. F. Arnold, of Manchester, England, shows and describes a homemade machine for grinding in taper plug cocks. The machine shows a special headstock which must be specially constructed. Fig. 1 herewith shows how any lathe may be adapted to grinding in plug cocks with the headstock retained. If such a machine is not available, a lightly built miller, as shown in Fig. 3, can be be used. For this purpose a slotted link



GRINDING COCKS

used to produce an oscillating movement of the spindle. *A* is the drive by means of belt pulley and gear, driving the gear *B* and the slotted link which communicates a reciprocating movement by means of the sliding block *D*. The transformed machine is adapted not only to grinding in plug cocks, but also to use as a miller for milling circular grooves where the circles are not complete, as shown in Fig. 2. For this purpose there is placed on the tool slide a small milling head, in which the milling spindle is driven from the countershaft. With little difficulty, the machine may also be rigged up to work automatically.

Even this does not exhaust the usefulness of the machine; it can be employed also for turning curves and, furthermore, conveniently, for backing-off milling cutters. (See Fig. 4). On the thread of the spindle is seated an eccentric, and in this is revolvably seated the arbor on which the cutter is mounted. In the eccentric is a spring pin which enters the indexing holes of the arbor and so secures the piece of work. The eccentric must be so placed that the most favorable curve is taken from the quadrant arc. In Fig. 4 such an arc outside of the cutter is denoted by cross-hatching. After backing-off a tooth the arbor must be shifted around. The oscillating movement of the spindle here needs to be only a small one, and the slotted link may be secured to the spindle, as shown in Fig. 3. Curves may also be turned.

Berlin, Germany. SIELEBIST.

What Ails the Pattern Shop

Under the title of "What Ails the Pattern Shop," page 803 AMERICAN MACHINIST, John R. Godfrey complains that the "pattern shop around the corner" is unable to make extremely difficult, specialized patterns, citing the new gasolene-engine crank case and cylinders cast in one piece as an instance. Now, this is a very complicated and difficult pattern to make, and over 90 per cent. of the small pattern shops have never had an opportunity to make one, and probably most of them never even saw one; and to expect them to make the most complicated patterns is like expecting the engineer of a small city to design a large cantilever bridge, or a 10-mile tunnel through the Rocky mountains; or to expect the local carpenter to superintend the construction of a modern sky scraper.

Mr. Godfrey also complains of the lack of accuracy shown by the modern patternmaker. For the modern patternmaker there are other things of so much more importance than extreme accuracy, that he justly considers that point as of lesser importance. Years ago, when the majority of patterns were of more simple construction than at present, and machine shops, also, were not so far advanced, accuracy was considered of prime importance, and a large percentage of patternmakers were the most accurate cabinetmakers, carpenters and millwrights obtainable. Today's requirements of interchangeability of machine parts, demand that all particular dimensions be machined, and today's highly efficient machine-shop equipment and the unavoidable inaccuracies and variability of castings, due to foundry conditions, make it generally advisable to machine parts rather than to attempt to obtain the necessary accuracy in the patterns. Of course, there are exceptions to these conditions; they being mostly thin, irregular castings, such as some used on the gas engine, but these do not comprise more than 10 per cent. of castings.

It cannot be expected that the local pattern shop can make any class of special patterns as well as a shop equipped for making that particular kind.

For instance, in making gear patterns, the small shop has no gear-pattern machinery, while the shop which specializes in gear patterns has in addition to the regular equipment, gear cutters, segment presses, universal wood workers, etc. And yet Mr. Godfrey seems to think that the local man should be able to make these patterns for a less charge than the special shop.

A much more important requisite of the modern patternmaker than extreme accuracy, is a broad knowledge of molding, and of the action of metal in cooling and contracting, that he may know how to make the pattern in the proper way for the molder; with good construction in regard to the strength of the pattern, and shrinkage and warping of timber. The pattern must be durable and one which will retain its original shape with hard foundry usage and also constructed to meet the requirements of the machine shop, such as convenience of chucking, tool clearance, etc.

The patternmaker should have the ability to quickly and accurately read drawings. In answer to Mr. Godfrey's complaint of the inability of the modern patternmaker to read drawings, I would say that, as far as my experience goes, the patternmaker is able to read drawings much better than any other mechanic, and that, other things being equal, a first-class patternmaker can usually read a drawing as accurately and quickly as the draftsman himself. It is more often the case of the drawing which is sent to the "pattern shop around the corner" being wrong, than of the patternmaker not being able to read it.

Battle Creek, Mich. H. N. T.

What is reported to be the largest radiator in the world has been constructed in Dresden, intended for the motor of an airship of 300 horsepower. It is made entirely of aluminum, is 4 feet 7 inches high, 4 feet 7 inches broad, and 8 inches deep. These dimensions are small when it is remembered that this radiator, with an hourly capacity of 6868 gallons, radiates no less than 288,000 calories per hour, while 1,695,000 cubic feet of air pass through it. At an external temperature of 68 degrees Fahrenheit, the maximum internal temperature is 167 degrees Fahrenheit. The weight is only 145 pounds empty and 209 pounds when full.

Dimensions of Piston Rods and Crossheads for Locomotives

The committee appointed by the American Railway Master Mechanics' Association to present formulas for the proper diameter of piston rods, and sizes of crossheads obtained data from locomotive builders. They found several different formulas and designs in use giving satisfactory results, so that representative

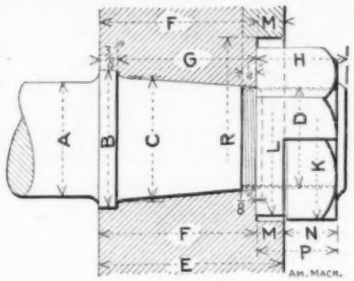


FIG. 1

groups of the data obtained were presented instead of recommending only one set of formulas for each part.

The dimensions of piston-rod end for piston rods with body diameter as shown are given in Table 2, Fig. 1.

The dimensions of the crosshead end are given in Table 3 and Fig. 2.

CROSSHEADS

The formulas for figuring crossheads to be used with the above designs of piston rods were not obtained, but drawings of the crossheads were furnished. A standard formula in terms of the diameter of the rod could not be derived to cover all the sizes. The dimensions of the crosshead hubs for cast-steel crossheads of the "alligator" type are given in Table 4 and Fig. 3, and will probably answer in lieu of formula.

PISTON RODS

The following formulas for piston rods are expressed in terms of the diameter of rod at root of thread on piston end.

Let

P = Pressure per square inch on piston,
D = Diameter of cylinder in inches,
d = Diameter of piston rod,
l = Length of rod between piston rod center and the center of the crosshead pin,
f = Allowable working compressive stress,
r = Least radius of gyration of rod.

A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S
2¼″	3½″	3″	2½″	4½″	3½″	3½″	2½″	5½″	3½″	3½″	¾″	1½″	2″	4½″	8
3″	3½″	3½″	2¾″	4½″	3½″	3½″	2½″	5½″	4½″	4″	¾″	1½″	2″	5″	8
3¼″	3½″	3½″	3″	5½″	4½″	4½″	2½″	6½″	4½″	4½″	1″	1½″	2″	5½″	8
3½″	4″	3½″	3½″	5½″	4½″	3½″	2½″	7½″	5″	4½″	1″	1½″	2¼″	6″	6
3½″	4″	3½″	3½″	6½″	5½″	4½″	2½″	8½″	5″	4½″	1″	1½″	2¼″	6″	6
3¾″	4½″	4″	3½″	6½″	5½″	4½″	2½″	8½″	5½″	5″	1″	1½″	2½″	6½″	6
4″	4½″	4″	3½″	6½″	5½″	5″	2½″	8½″	5½″	5½″	1″	1½″	2½″	6½″	6
4″	4½″	4½″	3¾″	7″	6″	5″	2½″	8½″	5½″	5½″	1″	1½″	2½″	6½″	6
4¼″	4½″	4½″	4″	7″	6″	5½″	2½″	9″	6″	6″	1″	2″	3″	7″	6
4½″	5″	4½″	4½″	7″	6″	5½″	3″	9½″	6½″	6½″	1″	2″	3″	7½″	6

TABLE 2. DIMENSIONS FOR PISTON END OF PISTON ROD

Then

$$f = P\frac{D^2}{d^2}. \qquad (1)$$

$$d = D\sqrt{\frac{P}{f}}. \qquad (2)$$

$$P = \frac{d^2 f}{D^2}. \qquad (3)$$

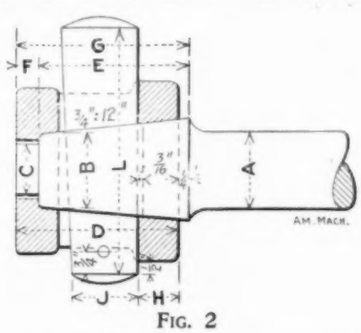


FIG. 2

A	B	C	D	E	F	G	H	J	K	L
2¼″	2½″	1 1/16″	5¼″	5¼″	¾″	6″	1½″	2½″	¾″	9″
3″	2¾″	1 1/16″	5¼″	5¼″	¾″	6″	1½″	2½″	¾″	9″
3¼″	3″	2 1/16″	6¼″	6″	¾″	6½″	1½″	2½″	¾″	9″
3½″	3″	2 1/16″	6¼″	6″	¾″	6½″	1½″	2½″	¾″	9″
3¾″	3½″	2 1/16″	7″	6¼″	¾″	7″	1½″	3″	¾″	10½
4″	3½″	2 1/16″	7″	6¼″	¾″	7″	1½″	3″	¾″	10½
4¼″	4″	3 1/16″	7¾″	7″	¾″	7″	2″	3½″	1″	11½
4½″	4″	3 1/16″	7¾″	7″	¾″	7″	2″	3½″	1″	11½

TABLE 3. DIMENSIONS FOR CROSSHEAD END OF PISTON ROD

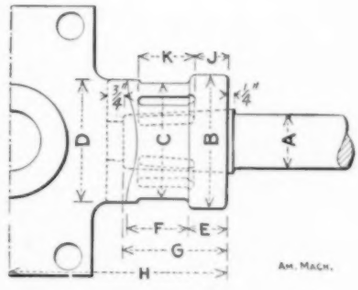


FIG. 3

Diameter of rod: A	B	C	D	E	F	G	H	J	K
2¼″ 3″	6½″	5¼″	6″	1¾″	3″	5″	10¼″	1½″	2 11/16″
3¼″ 3½″	7½″	6½″	7″	2″	3½″	5¼″	12″	1¾″	3½″
3¾″ 4″	8″	7″	7½″	2″	3½″	6½″	13″	1¾″	3½″
4¼″ 4½″	9″	8″	8½″	2½″	3½″	6½″	14″	2″	3½″

TABLE 4

The limiting bearing pressure for crosshead pins is 4800 pounds per square inch.

AREA OF CROSSHEAD SHOES

The bearing area of crosshead shoes, designed to be used with the above are: Top shoes, 7x24 inches, and bottom shoes 5½x24 inches, for piston rods 3¼ inches, 3½ inches and 3¾ inches diameter; top shoe, 8x24 inches, and bottom shoe, 6x24 inches, for piston rods 4¼ inches and 4½ inches diameter.

Under repeated alternate strains allow the compressive stresses given in Fig. 5. (From Pencoyd experiments.)

	Steel 1 41 (70,000 lb.)
	r d
20	13,360
30	9,540
40	8,380
50	7,760
60	7,120
70	6,520
80	5,940
90	5,300
100	4,680
110	4,220

TABLE 5

CROSSHEADS

The formulas for cast-steel crosshead hubs used in connection with the above piston rods are shown in diagram, Fig. 4.

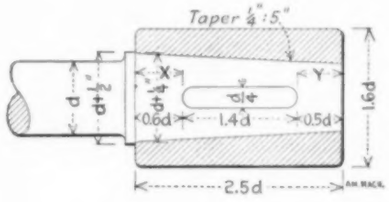


FIG. 4

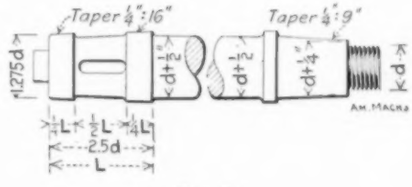


FIG. 5

The crossheads used with the above piston rods have following dimensions of hubs:

$\frac{2}{d}$ = distance from end of hub to keyway.

Piston pressure × 0.0003 = thickness of metal in outer end of crosshead hub for cast steel.

Bearing area in crosshead for crosshead pin = piston pressure divided by 12,000.

The three groups of formulas are presented as representative of the data obtained.

Eliminating the Inefficient Man

By John R. Godfrey

In all our discussions of efficiency, without regard to the particular brand of ism which it wears, we are very apt to overlook the naturally inefficient worker. While few of us will claim to be 100 per cent. men, and most of us are striving in one way or another to catch an extra per cent. or two for the ultimate fattening of our pocketbook, we must not overlook the man who is naturally incapable of a high percentage of efficiency.

The great majority of people can learn or be taught more efficient methods of working and of living, and this training is one of the great fields for the efficiency engineer. But those who have studied human nature, adepts in the various "ologies," know that too large a percentage of any people are mentally incapable of a high order of efficiency in any line. Some possibly less than Mr. Taylor's famous gorilla.

In the natural order of things these people will be weeded out of every line of industry by any management which is striving for efficiency in order to have a well trained force of workers. And this brings us to the question of what is to become of them.

For even the most scientific of managers, no matter how strongly he talks "the survival of the fittest theory," has absorbed enough "mawkish sentimentality" to hesitate at advising either starvation or some of the quicker methods of extermination.

This is by no means a plea for inefficiency, for we all know that a better knowledge of life, of how work can be done more easily and quickly, should make it better for all concerned. But we do not forget that no matter what efficiency we attain, the naturally inefficient worker must live in some way. If we crowd him out of all industry, we must support him in some institution or by a pension. This burden must fall on both the employers and the employed, and will be bad for the man supported.

Of course, there is little danger that scientific management will grow to such a point that all industry will be closed to the naturally inefficient man for several years to come, but the only way to judge of the ultimate value of any plan or method is to follow it to its logical conclusion. And this conclusion points inevitably to the ultimate pauperization of the person who falls below the minimum standard of efficiency.

For, while his mentality might place him in the pig-iron handling class, his physical incapacity would rule him out of any thoroughly efficient body of laborers, as Mr. Taylor weeded out 460 from a body of 600. And as the laboring gang is about the lowest on the list, it is a grave question what will become of those who are inefficient in that class.

This is not only bad for the individual, but it deprives the community as a whole, of whatever they can produce. All of which goes to show that it is barely possible that an average efficiency of 50 per cent. may be just as well for the community as to have half of them raised to 100 per cent., and the rest forced out as inefficient.

It should also be remembered that the mentally inefficient do not all belong to the working class. I recall an officer of a well known insurance company who drew a salary of $30,000 a year simply because the company was a family affair. If he had been paid for his actual capacity, his salary would have been about $15 a week.

Let it be throughly understood that there is not the slightest desire to claim that any of us are efficient enough or to decry the efforts being made to improve men and methods. Nor can it be compared with the advent of labor-saving machinery, because the latter can be opered by 50 per cent. men and still save money. But the elimination of the 40 per cent. man who, from mental incapacity, can never be any more, is a problem to be studied.

Floating Screw Machine Tools

By S. N. Bacon

In screw-machine work it is often necessary for reamers and other turret tools to be made to float, so that they will follow the drilled hole.

I show in Fig. 1 a reamer holder, which is cheap and simple, though there are fewer of them in use than of the more expensive kind.

When a reamer is held in a solid holder, which does not line up perfectly with the spindle, it cannot cut a straight true hole, but with a reamer held in the manner shown, it will follow the drill hole and does not cut large or tapering.

The large hole is made about 0.040 inch larger in diameter than the shank of reamer, and the pin hole about 0.030 inch.

Very small reamers are made with a larger shank, which can be a standard size if desired, in order to use the same holder for all reamers, or, another method would be to have one holder and a bushing for each size reamer, as in Fig. 2. The reamers would be cheaper when made with one diameter.

A counterbore is shown in this holder. Very often a counterbore held solid in the turret will cut large and the pilot on the counterbore will be useless as a guide if it does not line up with the hole already made, but these troubles are eliminated with the floating tool.

At *A*, Fig. 3, is shown a small roller, which must be nearly perfectly round, and the hole lined up exactly with the outside diameter. Many methods were tried to make this piece, but it always had to be ground, which was very expensive, and with poor results, on account of the small hole.

The hollow mill, Fig. 3, was then made with the pilot, which is shown, pressed in from the rear. This tool was held in the floating holder described above. In operation, the pilot enters the hole, guiding the hollow mill and producing a concentric roll, a collar of the usual type being used to adjust the hollow mill.

Most every screw-machine operator can easily recall a threading job which always gives trouble. Some screws, usually with long threads, give trouble every time they are made. Make new dies, anneal the stock, try every speed possible, throw away the button die and use a hollow mill, die or *vice versa*, and in spite of all the threads will strip or the the pitch diameter be off. The scheme shown in Fig. 4 will cure these troubles, and after a fair trial will give the best results. The regular die holders can be altered to take the floating die.

To try this last scheme in a hurry, having only a regular hollow-mill die, and not the convenience to anneal it, in order to drill the hole, I suggest that the simple method shown in Fig. 5 be used. Grind three small grooves across the back end of the die and hold with three pointed screws, which are already in the button die holders.

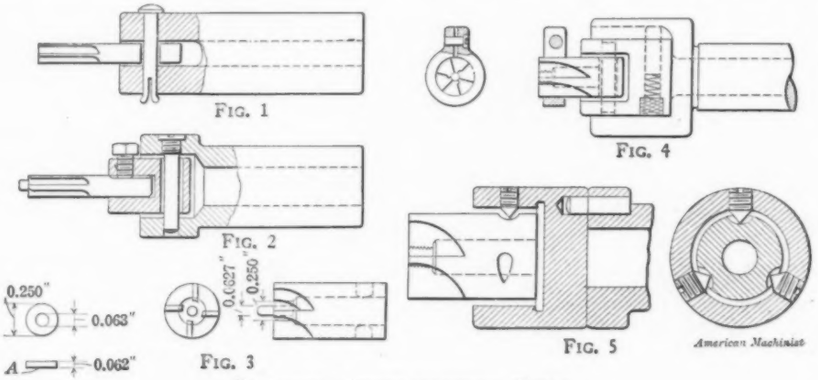


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5

Floating Screw-machine Tools

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American Machinist

The Prevention of Fires

It is interesting to note the increasing attention to the problem of fire prevention, both by underwriters and insurance men and the manufacturers in various lines. The figures given by the former are staggering in their amount, and represent a direct loss to the world at large with no corresponding gain, unless at times it be the wiping out of undesirable structures, which makes way for the erection of better buildings. But this is only true in a comparatively few cases and, while some profess to see benefit in the work made necessary by rebuilding, this is an illogical view.

If we could eliminate carelessness in the handling of matches, lamps, gasolene and other substances, which is too often at the bottom of most of the disastrous fires, our fire loss would decrease to such an extent as to be a serious menace to the prosperity of fire insurance companies. And this carelessness extends from the newest apprentice up to the president's private office.

While many of the fires are directly caused by smokers, it is very largely because they have more opportunities to be careless than the non-smoker, and, in proportion to his opportunities, it is probably safe to say that the non-smoker is about equally careless. There is, however, the probability that the constant handling of matches without disastrous results makes one more careless with them.

At the recent foundrymen's convention it was urged that the use of matches be prohibited in all foundries and shops, and that some other means of lighting cigars, pipes and the more useful torches and other instruments which may be necessary, be provided in all shops. Prohibitory laws are always distasteful and arouse antagonism, even in those who would be perfectly willing to follow the suggested lines of their own free will, so that it is always better to secure, if possible, coöperation in the inauguration of any movement of this kind. But the suggestion of providing a substitute is along the right lines.

While urging all the precautionary measures which are practical, we should aim to cultivate the sense of individual responsibility all along the line, few of us being beyond improvement in this direction.

While it is not always easy to see that a heavy fire loss in San Francisco in any way affects residents of Boston, this must be the case, because a portion of the wealth of the country has been wiped out of existence. But it should be comparatively easy for anyone to see the direct result of carelessness might be the destruction of the plant in which we are employed and this would throw us out of work, temporarily, at least, and be a hardship to everyone concerned.

Knowing, however, that all humanity is liable to be careless at times, some efficient means must be provided for checking a fire as quickly as possible after it starts and, up to the present time, there seems to be nothing equal to a well installed sprinkler system.

Three Methods of Management

There are two extreme positions taken by shop managers with regard to their output. One pays all of his attention to keeping the payroll as small as possible, while the other studies his machinery to the exclusion of the men. The former is the most numerous, but neither is as near the mark as the man who takes the middle course and studies both men and machines, with a view to their effect on cost of production.

The first man will insist on one man running three machines, which represent an investment of say $6000. The second would pay little attention to the way the machines were being run if they were the best of their kind. But the third man would probably find that the machines could produce 10 per cent. more work if the man was trained, had a helper and confined his attention to only two machines. And 10 per cent. interest on the investment would almost pay for another man, who could also handle a fourth machine.

In fact, there are many places where it would pay to confine a man to one machine, and give him a helper if the work was brought up to the full capacity of the machine. The payroll would go up, but the cost of production would go down, both being equally desirable from any point of view.

Both men and machines should be studied with a view toward cutting out waste time and unnecessary work, always bearing in mind that the greatest permanent results must come from a careful consideration of the effect on both man and machine. For, while it may pay to wear out machines as rapidly as possible by getting out product rapidly, this cannot be applied to the men and the maximum effort should not carry them beyond the elastic limit of recuperation.

Current for Electric Cranes

The tendency in the use of electric power in shops seems to be toward the alternating current in spite of the convenience of the variable speeds to be obtained with direct-current motors. The absence of commutators and all contact with the moving parts of the motor seems to appeal to shop managers very strongly even though speed changes must be secured by gearing or other mechanical devices.

But some of the makers of electric cranes feel that for this part of the shop equipment at least, a direct current is much to be preferred, even going so far as to advocate a rotary transformer to secure it for crane service alone. For, while they make cranes with alternating-current motors, they seem to feel that much better satisfaction can be secured if direct current is used.

Another very important use of electricity where direct current is absolutely necessary, is in the magnetic chuck. This is often one of the greatest time savers in the shop and should be provided for, even where alternating current is used for power and light.

While a double system of any kind has many objections, this may be another of the frequent instances where no one device is best for all cases.

New Publications

Metal Work and Etching. By John D. Adams. Cloth; Eighty-eight 4½x6½-inch pages; 49 illustrations in the text; no index. Popular Mechanics Company, Chicago, Ill. Price, 25 cents.

This little book, one of the *Popular Mechanics* handbook series, tells the amateur how to etch copper and brass, and gives a number of designs for useful and ornamental objects that can be made by this process.

Mechanics for Engineers. By Arthur Morley. 290 5x7-inch pages, with 200 illustrations. Third edition. Longmans, Green & Co., London and New York. Price, $1.20.

This book aims to cover the general subject of theoretical mechanics sufficient for the intermediate engineering examinations of the University of London. This means that, while not elementary, it does not follow the subject as far as the standard textbooks used in our engineering colleges. In the nature of the case it is somewhat mathematical, although the calculus has been avoided.

While the analytical work is good, we cannot regard the author's fundamental definitions, on which so much depends, as happy. The formation of clear ideas of the fundamental concepts of mechanics is at best a difficult matter, but we should say that it is almost impossible if the student is to rely on the author's definitions of such concepts as inertia, mass and momentum. Apart from the question of philosophical soundness, which might be raised, it is important that these definitions be at least clear, and to us the author's definitions are not clear.

Practical Mathematics and Geometry for Technical Students, by Edward L. Bates and Frederick Charlesworth; 446, 5x7¼-inch pages with 267 illustrations. B. T. Batsford, London. The D. Van Nostrand Company, New York. Price $1.25.

The tendency toward the teaching of mathematics with the aid of concrete applications to mechanical problems is, of course, well marked and this volume is its most recent outcome. It makes no hard and fast division between the different branches of mathematics, but takes up in a natural and progressive order such subjects as vulgar and decimal fractions, the use of scales and squared paper, ratio and proportion, algebra, including simple equations with a hint at quadratics, and the use of formulas, geometric problems, plain trigonometry and logarithms.

It is sprinkled with practical applications which are really practical and it impresses us as well suited to the needs of trade schools of the more ambitious sort, although some portions of it would doubtless be omitted in such schools. Its scope is determined by the syllabus of the British Board of Education relating to practical mathematics.

Monoplanes and Biplanes. By Grover Cleveland Loening. Three hundred and twenty-three 8x5½-inch pages; 278 illustrations in the text; indexed. Munn & Co., Inc., New York City. Price, $2.50, net.

The nucleus for this book consisted of a thesis for the Master of Arts degree at Columbia University, previously published serially in the *Scientific American* supplement Nos. 1816 to 1822, inclusive. As now presented in book form, however, it contains much new material. There are three parts, with the following headings: The Design of Aëroplanes; Detailed Descriptions of the Notable Aëroplanes; Comparison of the Types. The first part, containing eight chapters, is a careful compilation of the results of the best experimental work to determine the pressure on planes, frictional resistance of the air, the center of pressure on both flat and curved planes, the effect of the depth of curvature, and aspect ratio upon the lift and drift of curved planes, closing with a numerical example in the design of an aëroplane. The largest section of the book is Part II which, after defining the terms used in aëroplane construction, describes and illustrates the important types of both monoplanes and biplanes. Part III, after taking up a comparison of the types, touches upon some of the vital questions, such as controlling systems, accidents, variable surface aëroplanes and the like. The chapter on accidents is especially timely. Two important facts are thus stated: (1) "Flying in gusty weather conditions is dangerous," and (2) "Descending by means of a long steep dip is still more dangerous." There has been an insistent demand for a book on aëroplanes that should present the theory of their design in a clear manner, free from mathematical complexity, and at the same time give an accurate description of existing constructions. This book meets both of these requirements.

A General Formula for the Shearing Deflection of Beams of Arbitrary Cross-sections, either Variable or Constant. By S. E. Slocum. Twenty-five 6x9-inch pages; 4 illustrations. J. B. Lippincott Company, Philadelphia, Penn.

This pamphlet is reprinted from the *Journal of the Franklin Institute* for April, 1911. Professor Slocum derives his general formula for shearing deflection from the principle of least work as applied by Castigliano to the deflection of beams. Some 21 pages are devoted to this derivation, and then follows a numerical application applying the final formulas in a study of the deflection of a planer rail. The final results, computed for a maximum load on the tool of 9280 pounds, corresponding to a cut ⅛x⅜ inch, is less than 0.0001 inch. It is, therefore, stated that the machine investigated may be considered as perfectly rigid for all practical purposes.

Personals

A. W. K. Billings, until recently engineering manager with J. G. White & Co., Inc., New York City, has accepted a position on the engineering staff of Dr. F. S. Pearson, New York.

Rupert K. Stockwell, who has been assistant general superintendent of the Alpha Portland Cement Company, Easton, Penn., has become mechanical engineer of the Tennessee Copper Company, Copperhill, Tenn.

William W. Manville, president, and Tracey F. Manville, secretary, have disposed of their interests in the Manville Brothers Company, Waterbury, Conn., and have severed their connection with that corporation.

George Braithwaite, factory manager of Stevens-Duryea Company, Chicopee Falls, Mass., has resigned to accept a position as superintendent of the machine shops of the Thomas B. Jeffery Company, Kenosha, Wis.

Theodore H. Curtis, superintendent of the machinery division of the Louisville & Nashville Railroad Company, Louisville, Ky., has resigned and expects to devote his immediate future to the development of several railroad appliances, of which he is the inventor.

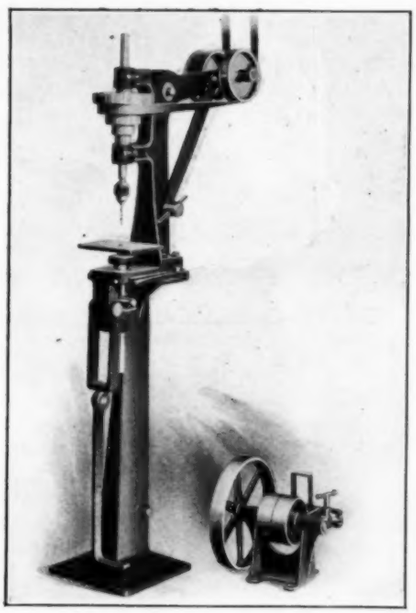
Shop Equipment News

High Speed Sensitive Driller

The accompanying halftone shows a new high-speed manufacturing driller, which in operation permits both hands free to handle work.

A long cast-iron bearing is used, and holes for spindle and table plunger are bored in line. The machine has a single belt drive, and changes of speed are effected from the front. The four speeds are in the ratio of 975, 1250, 1700, 2375, and the cone steps are 2½, 4, 5⅜ and 6¾ inches diameter for 1-inch belt. On easily handled brass or bronze work the driller has a capacity of fifty 3/16-inch holes per minute through ¼ inch.

The raising and lowering of the spindle



HIGH-SPEED SENSITIVE DRILL

is accomplished by loosening the spanner nut and giving a slight rap to the cone pulley to loosen the split taper binder inside, which does not mar the spindle when tightened. The table is adjusted by loosening the stop collar underneath the bed and clamping in the desired position. In addition to this there is a micrometer adjustment.

Several heads may be set in a row and a weight feed applied for deep drilling operations where the drilling occupies enough time for the operator to feed more than one head.

The machine is a recent product of the H. P. Townsend Manufacturing Company, Hartford, Conn.

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

Electric Shop Truck

The truck shown herewith is adapted for handling the products of manufacturing plants, and is driven by power from storage batteries incased in the steel box shown at the left end, so con-

ELECTRIC SHOP TRUCK

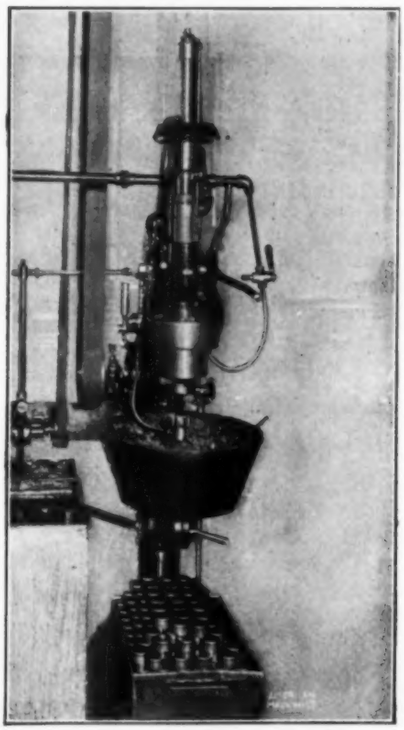
structed that the batteries may be easily removed. The other end of the truck consists of movable gate, hinged at the bottom, thus increasing by three feet the available loading platform. The loading space is 42 inches wide and the length 7 feet 1 inch, with gate up. The hight of the platform from the floor is 20 inches. The truck may be operated at a speed of from 2 to 10 miles an hour, weighs 1800 pounds, and will carry from 2000 to 3000 pounds. This type is also built with a double deck.

The trucks are manufactured by the Automatic Transportation Company, Buffalo, N. Y.

All Geared Tapper

The accompanying illustration shows a specially equipped 20-inch all geared tapper, built by the Barnes Drill Company, Rockford, Ill.

The machine is shown set up for tapping pressed-steel grease-cup caps, and is equipped with special spindles having Garvin air cylinders and chucks, which



AUTOMATIC GEARED TAPPER

were recently described in these columns, and a special cup-type table. The work is done by the inverted process, that is, the air chucks automatically grip and release the caps without stopping the spindle, and the work is thus revolved down on the tap, which is held in a Colburn floating tap holder in the cup-type table, and the oil is supplied from the center of the tap, as shown. This particular style of floating tap holder has also been described in these columns. With the oil supplied in this manner, it will be noted that gravity and oil force out the chips.

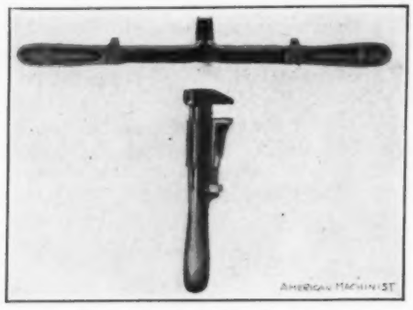
The machine shown is otherwise the regular type of automatic all-geared tapper made by the Barnes Drill Company and previously shown.

Cresco Monkey Wrench

The illustration herewith shows a new monkey wrench recently placed on the market, the upper portion of which shows one of the forgings from which the wrench is made.

As will be seen the wrench consists of but three parts, which are made of drop-forged steel.

In order to replace a bent or broken jaw it is only necessary to knock out the two rivets which hold the split handle together, spring the handle apart, and insert the new jaw. The jaws are, however, made of steel forgings which is apt to make this operation very seldom necessary.



"Cresco" Monkey Wrench

This type of wrench is manufactured in all sizes from 6 to 18 inches by the Crescent Forgings Company, Oakmont, Penn.

Double End Centering Machine

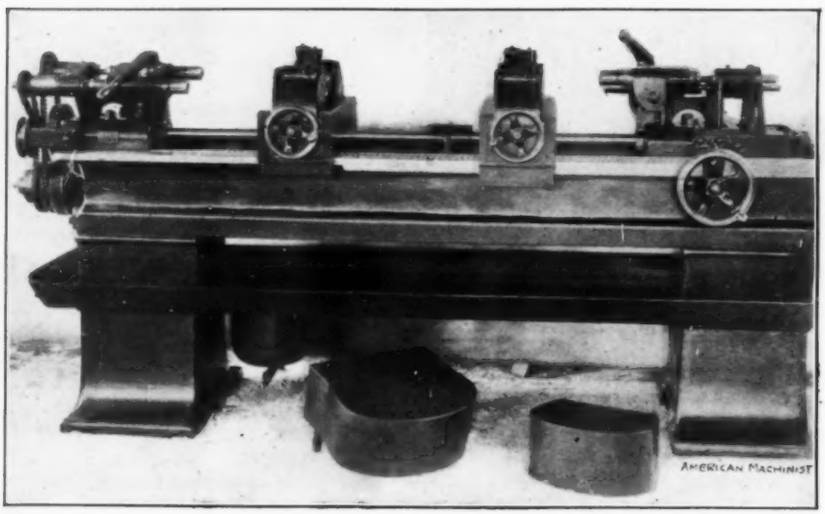
The accompanying illustration shows a machine designed for centering bar stock. The bed is of the standard lathe-bed type, made in any length, with a number of box bridgings. The V's are 40 degrees, with tops slightly rounded. The illustration shows the head and a little over half of the bed length of a 10-foot machine.

The centering heads have renewable spindle bearings of bronze; hammered steel spindles with ground bearings. The spindles have hand-lever feed, by means of rack and pinion. The heads are pivoted, so by tilting slightly, either the drill or countersink is brought into the centering position. The left-hand head is stationary, while the right-hand head is adjustable along the entire length of the bed, by means of rack and pinion.

The chucks are self-centering, with jaws of hardened steel, operated simultaneously by means of right- and left-hand screws. The work is centered automatically and the chucks are adjustable to any required position.

The driving mechanism consists of a shaft running the entire length of the machine and from this, the centering heads are driven by means of silent chain, the guards for which are shown in the foreground of the illustration.

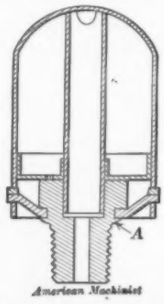
This machine is built by Fay & Scott, Dexter, Maine.



Double-end Centering Machine

Loose Pulley Oil Cup

The accompanying sectional view illustrates an automatic loose-pulley oil cup, which will run from one to three weeks per filling, according to the number of starts and stops, speed, etc.



Automatic Loose-pulley Oil Cup

When the pulley is brought into operation the centrifugal force throws the oil to the top of the cup and fills the feeding tube. When the pulley starts next time, a portion of the oil in the tube is fed to the bearing, and the tube again fills itself.

The cup can easily be detached from the nipple for filling by hand, and can be removed, filled and replaced with the pulley in any position.

It is made of thin pressed steel by the American Specialty Company, Chicago, Ill.

Back Geared Crank Shaper

The accompanying illustration, Fig. 1, represents a 16-inch back-geared shaper, recently developed by the Queen City Machine Tool Company, Cincinnati, Ohio.

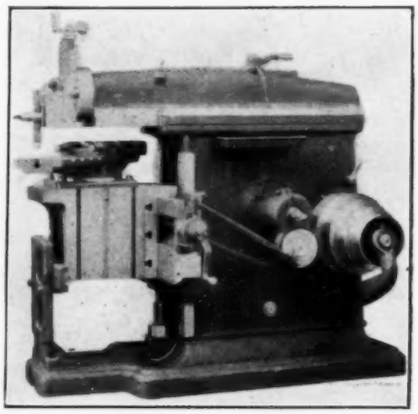


Fig. 1. Back-geared Crank Shaper

All of the important bearings have heat treated and ground journals running in cast iron. The body of the crank pin is a crucible-steel casting, has a heat-treated sleeve pressed over the pin, and is ground to be a running fit in the cast-iron crank block; this block has an oil reservoir with channels cut to insure thorough distribution of the oil, which is lifted from the reservoir onto crank pin

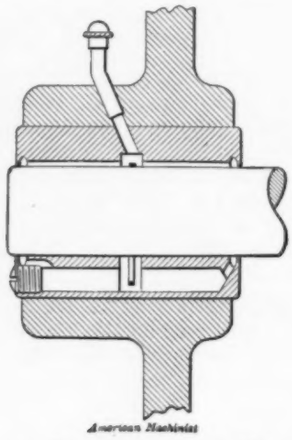


Fig. 2. Type of Bearing Used in Queen City Shaper

by a chain, the oil always flowing back to the reservoir; thus a continual flow of oil results if proper attention is paid to providing a supply of good oil, as means have been provided for drawing off the oil when used up and replacing it with a fresh supply. The type of bearing used is shown in Fig. 2. The bull-wheel hub also has a hardened sleeve pressed over it, and is afterward ground to size; the same oiling device is used here as on crank pin. The cone-pulley shaft has a three-point bearing, eliminating the overhang at drive. The five journals of the driving and driven shaft are heat treated and ground, run in removable cast-iron bushes, and are kept flooded with oil by means of ring oilers. Eight speeds and twelve feeds are furnished, which can be so combined as to cover every requirement for the turning out of work rapidly.

The arch ram is of rigid construction, while the design and position of the table support and rigid construction of the column, rail, etc., enables the work to be held solidly while being machined. The table support is closely gibbed to table, eliminating both the up and down movement of the work. The base has an extra solid footing, as it is made very long to bring table support out the extreme end of table.

The shaper is designed very low and long, making it handy for operators. This long and low design also provides for long ram bearing in column. All flat bearing surfaces are of large area and gibbed for taking up wear. Feed screws have micrometer adjustment and swivels are graduated.

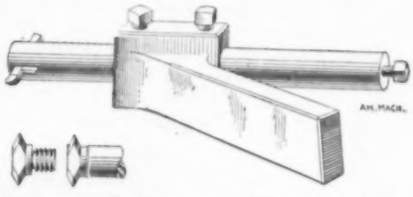
Garvin Plain Miller

The miller here shown is designed primarily for manufacturing purposes. It is a powerful machine of large capacity, with the parts reduced to the plain essentials. The spindle has a No. 11 Brown & Sharpe taper hole with driving slot, runs in adjustable bronze boxes, and is driven by a 12-inch cone and 4-inch belt, geared 5¼ to 1. A new departure will be noted from Fig. 1 in that one side of the machine is closed, joining the arm and spindle bearings rigidly together and to the body of the machine, thus securing solidity and freedom from vibration. The feed is driven from spindle on back-shaft at will by throwing an accentic giving a range of 1/200 inch to ¼ inch per turn of spindle. Changes are provided by change gears and drive is by wide belt with tightener.

The large oil groove table is driven by a non-rotating screw and rotary steel nut, both screw and nut being hardened. The hand feed is by large handwheel and spiral gears running in oil. The rotary feed nut is driven direct by a hardened-steel worm gear and worm running in oil. The feed box is built into the saddle so that the stresses are taken in the most direct manner with the least number of joints. The saddle is massive and has micrometer adjustment in and out. The knee has the Garvin closed top construction and is raised by micrometer handwheel and screw, which does not pass through the floor. The arm is exceptionally large, and the braces connect saddle and arm, leaving the yoke free to adjust to suit arbor and position of cutter. All gears are protected. The machine weighs 3050 pounds and is a recent product of the Garvin Machine Company, New York City.

Boring and Internal Threading Tool

The boring bar and internal threading tool shown herewith has just been placed on the market by the Ready Tool Company, Bridgeport, Conn., and has a simple holding device which insures rigidity.



BORING AND INTERNAL THREADING TOOL

In this tool the cutter is held in place by a setscrew in the back of the bar, forcing the rod running through the bar up against the sliding wedge which holds the cutter from all movement. This keeps the cutter in alinement and tends to avoid all chatter.

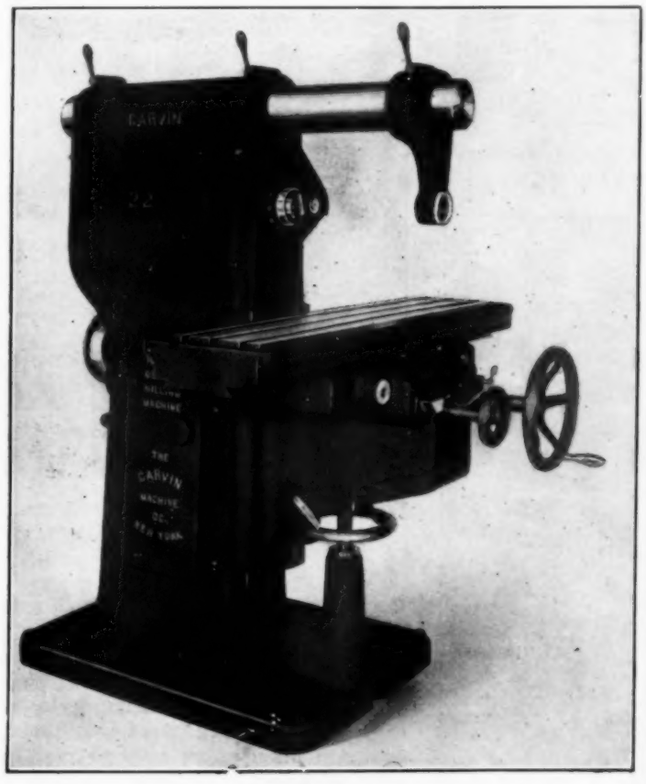


FIG. 1

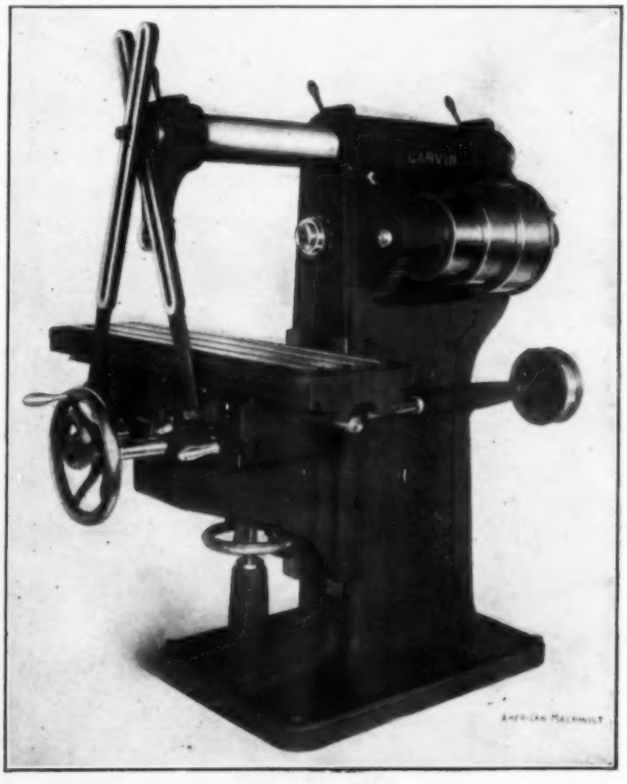


FIG. 2

TWO VIEWS OF GARVIN PLAIN MILLER

To sharpen the cutter it is only necessary to run back the lathe carriage and loosen the setscrew which releases the wedge, take out the cutter and sharpen, after which the holder is placed back and the setscrew tightened. By then running the carriage back, constant level and alinement has been maintained.

The bar is held rigidly in the holder by a sliding dog, forced down by two setscrews. This gives a means of adjustment so that the bar can be taken out and replaced with a piece of solid steel ¾ inch or ⅜ inch in diameter for boring small holes.

An internal threading tool is also furnished, which has a cutter screwed in the end as shown, ground to the usual 60-degree angle. The size of the holder is ⅜ inch by 1¼ inches.

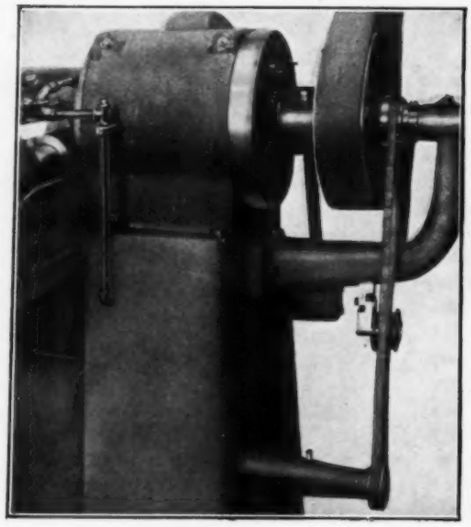


FIG. 2. REAR VIEW OF PINION CUTTER

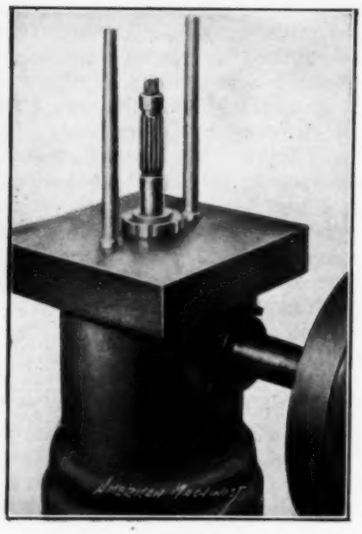


FIG. 3. A REAMING MACHINE

A Pinion Cutter and Other Tools

EDITORIAL CORRESPONDENCE

An interesting type of single-purpose machine is a new pinion cutter built by the Cleveland Planer Works, Cleveland, Ohio, for cutting bull-wheel pinions used on their planers. These pinions are two sizes: 6 inches long, with 3 pitch teeth and 11 inches long, 2½ pitch, and are made of 45 to 50 point carbon steel. The machine weighs 6000 pounds, is driven by a 4-inch belt and feeds at the rate of 1¼ inches per minute with a cutter velocity of 30 feet.

Fig. 1 shows the machine with a partially finished pinion in place and it will be seen that the pinion and its shaft are one solid piece. The pinion shaft is held in the index head by means of a draw-in collet, which is locked by tightening the collar *A*. The index plate *B* is unusually large and is locked by the latch *C*. Adjustment of the cutter spindle for depth of cut is obtained by loosening the clamping bolt *D* and rocking the head *E* which is eccentric, the position of the gearing in the head making this possible without disturbing any of the working parts. The table may be fed by hand by using the handle *F* and the clutch *G* for the power feed, is thrown in by the lever *H*. Stop *I* operates by striking the roller *J* on the clutch lever. Oil is drained from the table through a telescoping tube at *K*, which also acts as a safety stop, preventing the cutter from being butted into the index head when running back for another cut. No centering device or extra collars are needed on the spindle, as the cutters used are made exactly the same thickness.

A partial rear view is given in Fig. 2 and shows the oil pump belt running on

FIG. 4. EXPANDING CHUCKS FOR HOLDING LARGE GEARS

FIG. 5. HYDRAULIC PRESS FOR PRESSING DRIVING GEARS ONTO BULL GEAR PINION SHAFT

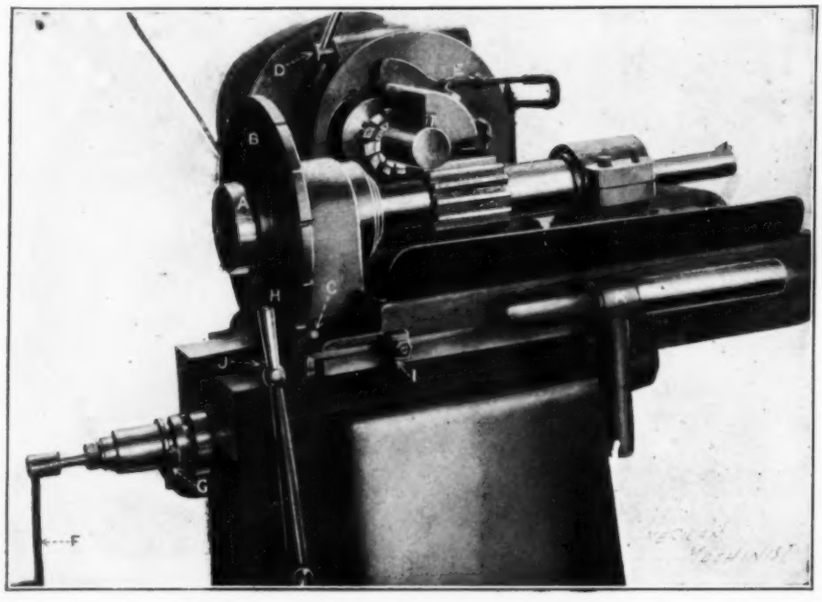


FIG. 1. A SPECIAL BUILT PINION CUTTER

the driving-shaft clutch collar, so that as the clutch is thrown out, the pump automatically stops.

A Pulley Reaming Machine

A reaming machine used principally for reaming out pulleys, is shown in Fig. 3. This machine is strictly homemade, the base being part of an old water main. The reamer is run from the driving shaft through bevel gears and the pulleys are kept from turning by resting the spokes against the upright bars in the table.

Gear hubs or sides are faced off by placing the gear on an expanding mandrel or chuck, shown at *A* and *B*, Fig. 4. These mandrels screw directly into the nose of the lathe spindle and are expanded by driving in the taper plug *C*.

Fig. 5 shows a shop-built hydraulic press used for pressing driving gears onto the bull gear pinion shafts. The piston of this press has an area of 100 square inches and the pump plunger an area of ½ square inch, which with the pump handle leverage gives the press a capacity of 100 tons. The tank inside of the piston into which the oil is returned furnishes enough oil for a 3½-inch stroke, which is all that is required, though with additional oil the machine can be used for about a ten-inch stroke.

The "Olympic", Largest Steamship Afloat

The White Star Line steamship, "Olympic," the largest afloat, docked at New York June 21, after its maiden voyage. The new steamer is 182½ feet longer than the hight of the Metropolitan Tower, the highest office building in the world.

The following are some of the more interesting figures concerning the immensity of the "Olympic": Length over all, 882 feet 6 inches; beam, 92 feet 9 inches; depth, 97 feet 4 inches (bottom of keel to boat deck); gross tonnage, 45,000; displacement, 52,000 tons; draft, 34 feet 6 inches; cargo capacity, 5600 tons; passengers provided for, 2500; crew, 850.

In addition to luxurious suites of rooms there are a swimming pool, a squash rackets court, electric passenger elevators, etc. A bilge or fin keel keeps the ship from rolling.

In connection with the machinery, the feature that has created the greatest interest is the combination of reciprocating engines (operating the two wing propellers) with a low-pressure turbine (operating the center propeller. This arrangement is economic and reduces the vibration of the ship. By means of a large change-over valve, consisting simply of a deflector piston in a casing, and operated through a hydraulic reversing gear controlled by a lever on the starting platform, the turbine can be cut out and the ship run, as ordinarily, with twin screws. The total horsepower is 46,000.

The electrical generating and distributing equipment is equal to the central station of a small town. There are about 150 motors on board, ranging in size from ½ to 40 horsepower.

Special Tools for Automatic Screw Machines

One of the interesting tool equipments recently furnished by the Cleveland Automatic Machine Company, Cleveland, O., with one of their machines, is shown in the accompanying illustrations. One of the pieces is shown at Fig. 1 with a quarter section sawed out in order to show the exact outline of the interior and the way in which the central stem is under cut.

Fig. 1. The Piece to be Turned and Under Cut

These are made from the bar of 1 5/16 round brass. Fig. 2 shows the brass bar *A* projecting from the chuck, and the hollow counter bore *B* fed in to its full depth to remove the stock in the recess, but leaving the central core *X*. Inside the hollow counter bore is a flat cutter with rounded corners and a central projection which centers the stud for the drill and rounds the corners on the outside.

This is shown better by the section in Figs. 3 and 4, which shows the cross-section of the piece, both before and after drilling the central hole. While the cross-slide tool *D* is turning the grooves on the outside of the piece, the recessing cutter *E* is at work, turning down the outside of the central stud so as to leave a square shoulder under the head. This is accomplished by the pin *I*, which projects from the body *E* of the recessing tool through an elongated slot in the outside holder *J* and strikes the stop *H*, which is on the cross slide. This prevents the further forward movement of the body *G*, while the continued movement of the turret forces the holder *J* forward, and as the end acts on the bevel on the outside of the recessing cutter *E*, this is forced down into the work, cutting the recess and leaving the square shoulder as shown. As the holder *J* is withdrawn, the spring shown between the cutter *E* and its body *G*, forces it away from the work and allows it to be withdrawn in the usual way.

The third and last operation consists in simply drilling the hole in the center of the stud and cutting the piece from the bar, which is a quick and efficient method of finishing work of this class.

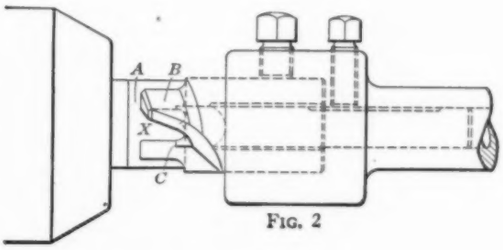


Fig. 2

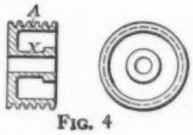


Fig. 4

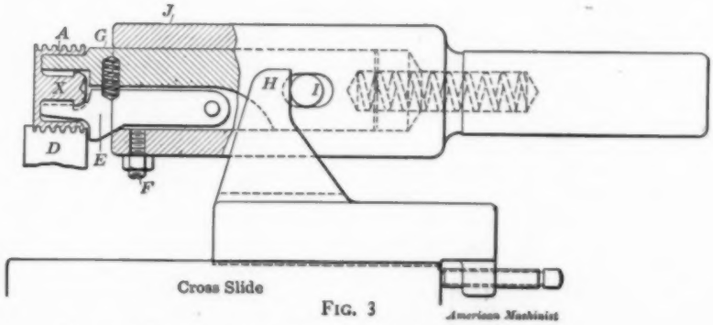


Fig. 3

Special Tools for Automatic Screw Machine

Increasing Shop Capacities

Metal Working

NEW ENGLAND

I. R. Blumenthal will erect a brick garage, 43x107 feet, at 106 Ann street, Hartford, Conn.

Worcester Electric Light Company, Worcester, Mass., will construct a commercial garage.

The jewelry plant of H. J. Flint, Providence, R. I., was badly damaged by fire. Loss, $20,000.

The H. H. Sprague Company, Bridgeport, Conn., manufacturing gas meters, will build an addition to plant.

R. N. Bassett Company, of Shelton, Conn., manufacturing corset wire, will build an addition to its factory.

J. R. C. Browning has received a permit to erect a commercial garage at 70 Bliss street, Springfield, Mass.

The New London Ship and Engine Company, Groton, Conn., is planning to erect an addition to machine shop.

The Millers Falls Company, of Millers Falls, Mass., manufacturing hardware, etc., will build two new factory buildings.

The McNab Company, Fairfield, Conn., has been incorporated with $50,000 capital to engage in the manufacture of tools, etc.

Smith & Delahanty, Inc., Hartford, Conn., has been incorporated to make pumps, switches, tools, etc. Capital, $50,000. Incorporators, Martin V. Smith, J. J. Delahanty, etc.

The Humason & Beckley Manufacturing Company, New Britain, Conn., has disposed of its bright wire-goods department and will use that space for the enlargement of its cutlery department.

MIDDLE STATES

The Cartercar Company, Pontiac, Mich., is erecting a new large machine shop.

The Michigan Steel Castings Company, Detroit, Mich., is to enlarge its foundry.

The Chicago Ornamental Iron Works, Chicago, Ill., will erect a two-story addition.

The Van Dorn Iron Works Company, of Cleveland, O., will erect a new factory building.

The Hydraulic Press Manufacturing Company, Mt. Gilead, O., will build an extension to its shop.

The Quaker City Cab Company, of Philadelphia, Penn., will build a large addition to its garage.

The Hawley Down Draft Furnace Company, of Chicago, Ill., will erect a plant at Easton, Penn.

George Schirrmann will erect an addition to his machine shop on West Fifth street, Portsmouth, O.

The American Roller Screen and Stamping Company, of Chicago, Ill., will move to Greenfield, Ind.

John E. Lonergan will build an addition to his foundry on Florist street, west of Second, Philadelphia, Penn.

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

The American Steel and Wire Company has taken out permit for an addition to its plant at Allentown, Penn.

The Hall-Miller Company, Chicago, Ill., manufacturing iron and brass bedsteads, will move its plant to Marinette, Wis.

The Cleveland (O.) & Pennsylvania Railroad Company will spend several million dollars on improvements and equipment.

The Blystone Manufacturing Company, Cambridge Springs, Penn., will erect an addition. The concern makes concrete mixers, etc.

The Banner Electric Company, Youngstown, O., will erect additions to its plant which will involve an expenditure of $250,000.

Plans have been completed for the large new steel mills to be erected at Midland, Penn., by the Pittsburg Crucible Steel Company.

The Alden Sampson Manufacturing Company, of Detroit, Mich., is soon to erect a new factory for the manufacture of motor trucks.

The Peter Smith Heater Company, of Detroit, Mich., which manufactures street-car heaters, will move to Ypsilanti and increase its output.

The Everitt-Metzger-Flanders Company has let the contract for a three-story addition to plant on Scotten and Hickory avenues, Detroit, Mich.

The Ellis Keystone Agricultural Works, manufacturer of agricultural implements, will build an addition to its plant at Pottstown, Penn.

Plans are being prepared for two additions to the plant of the Kinsey Manufacturing Company, Toledo, Ohio, manufacturer of automobile parts.

The American Foundry and Machine Company, Hamilton, O., has let the contract for their new foundry extension and is in the market for equipment.

The Metal Embroidery Hoop Company, Canton, O., has been incorporated for $50,000 by N. A. Sponseller, to manufacture metal hoops for embroidery work.

The Canton Foundry and Machine Company, of Canton, O., has increased its capital from $50,000 to $100,000 to provide for a large addition to the plant.

Plans are being drawn for a four-story addition to plant of Edward Schuster & Co., on Fourth street, Milwaukee, Wis., in which will be located machine and carpenter shops.

The Vohr Ozone Electric Company, Chicago, Ill., has been incorporated to manufacture ozone generators, air purifiers, etc., by Harold E. Beck, Percy V. Castle, etc.

The Black-Clawson Company, Hamilton, O., manufacturers of paper-mill machinery, has let contracts for a foundry extension, for which new equipment will be required.

The A. J. Schindler, Chicago, Ill., has been incorporated to manufacture machinery and appliances. Capital, $12,000. Incorporators, Andrew J. Schindler, Albert Duffels, Joseph Zeidek.

The Cincinnati Aëroplane Company, Cincinnati, O., has been organized to manufacture aëroplanes and airships by Louis Muller, Rud K. Hynicka, Michael Muller, etc. Capital, $20,000.

The Superior Metal Products Company, Elyria, O., has been organized with $15,000 capital to engage in the manufacture of specialties. Incorporators, H. E. Hall, L. H. Lang, etc.

Foot Brothers Gear and Machine Company, 214 North Carpenter street, Chicago, Ill., is putting up a three-story addition to its factory, which will be equipped with modern machinery.

Contract has been awarded for erection of plant for the Independent Foundry Company, a new concern, at Emporium, Penn., to W. H. Kramer at that place. Steel pipes will be manufactured.

The Fulton Machine and Forging Company, of Canal Dover, O., has erected an addition to the plant and will install a large amount of new machinery. The company makes steel drop forgings.

The University Garage, New York, has been incorporated to operate garage. Capital, $120,000. Incorporators, C. R. Duque, 440 Riverside Drive, H. H. Boolson, 80 Washington place, etc.

Plans are being prepared for a five-story factory building for the Buckeye Iron and Brass Works, Dayton, O. This is in addition to new building to be used as a foundry, now being erected.

The Henry H. Martin Manufacturing Company, Louisville, Ky., has been incorporated with $10,000 capital by Henry H. Martin, Charles J. Bear and George L. Martin, to operate machine shop.

Automatic Specialties Company, Cincinnati, O., has been incorporated to manufacture machinery and specialties. Incorporators, Herman A. Holz, Arthur E. Reuss, Oscar Schnitzler. Capital, $10,000.

The Dayton (O.) Automobile Company, has been incorporated for $30,000 to manufacture, sell and repair automobiles. Incorporators, J. N. Agentroad, C. N. Hunter, J. E. Studebaker, etc.

The Twenty-fifth Street Garage Company, New York, has been organized with $50,000 capital by Henry Hencken, 534 West Twenty-seventh street, Edward L. Larkin, 315 West Fourteenth street, etc.

The Cleveland (O.) Auto Starter Company has been incorporated for $25,000 to manufacture a patented starter for automobiles. Incorporators, E. A. Curtis, R. F Cragin, V. M. Soika, etc.

The Stanley Differential Hub Company,

Logansport, Ind., has been incorporated with a capital of $60,000 by E. D. Morgan, G. M. Stanley, Clark and Joseph Taylor, to manufacture automobile parts.

The Standard Fixture and Supply Company, Cleveland, O., has been incorporated with $10,000 capital to manufacture gas and electrical-lighting fixtures by A. J. Schur, William Rockwell, A. C. Knuth, etc.

The Citizens Motor Car Company, Cincinnati, O., will erect a three-story garage adjoining its present location and also build another large garage in Hyde Park, which will have a fully equipped repair shop.

The Indianapolis Gas Engine Company, Indianapolis, Ind., has been incorporated with a capital of $10,000 by Thomas Strack, W. P. Best, H. A. Noffke and B. N. Lay, to manufacture a newly invented gas engine.

The Barbee Air Grate and Manufacturing Company, Owensboro, Ky., has been organized with $25,000 capital to manufacture furnaces and sheet-iron products. Incorporators, T. M. Barbee, C. W. Yaeger, etc.

The Mechanical Machine and Tool Works, Chicago, Ill., has been incorporated with $6000 capital to manufacture and deal in machinery, patterns, hardware, etc. Incorporators, Henry S. Jewell, F. L. Rissling, etc.

The Parrott Heater Sales Company, Dayton, O., has been organized with $10,000 capital to manufacture and sell automatic gas-water heaters. Incorporators, George E. McCandliss, John B. Branch, A. G. Kerns, etc.

A new foundry is to be erected at West Hamburg, Penn., by a concern to be known as the A. & H. Foundry Company, composed of Edgar Amole, of Reading, and Frank Harpel, of the Topton (Penn.) Foundry Company.

Belmuth Manufacturing Company, Cleveland, O., has been incorporated to manufacture all kinds of gas and electrical-illuminating fixtures. Incorporators, Philip J. Atzberger, E. M. Zeilman, M. A. Atzberger, etc. Capital, $10,000.

The W. E. Keene Company, Cleveland, O., has been organized with a capital of $10,000 to manufacture and sell sheet-metal articles and structural and ornamental iron and steel by Clate B. Vinton, W. D. Elliott, William E. Keene, etc.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids on July 11 for radial drill, sensitive drill, emery grinder, engine lathe, speed lathe, shaper for navy yard at Hingham, Mass., as per Schedule No. 3718.

The Hutchins Manufacturing Company, of Buffalo, N. Y., has bought the Kilbourne Manufacturing Company, of Troy, N. Y., and is moving the plant to Buffalo. The combined business will be operated under the name of the Hutchins-Kilbourne Company, makers of wire goods and hardware. The Hutchins-Kilbourne Company has also bought the plant of the Eureka Steel Novelty Company, of North Tonawonda, N. Y., and will continue there a factory for making novelties.

SOUTHERN STATES

The Mascot Stove Works, Dalton, Ga., will increase capacity of plant.

The plow factory of the Wells-Jones Company, Jackson, Tenn., was destroyed by fire. Loss, $10,000.

The Laclede Steel Company, a new concern, has acquired site near East St. Louis and will erect rolling mill to cost $300,000. T. R. Akin, of St. Louis, formerly general superintendent of the East St. Louis plant of the Republic Iron and Steel Company, is president of the new company.

WEST OF THE MISSISSIPPI

The roundhouse of the Santa Fe Railroad at Seligman, Ariz., was destroyed by fire.

Deetz & Co., Duluth, Minn., manufacturers of roofing and sheet metal, is enlarging shop.

The Woodill & Hulse Electric Company, Los Angeles, Cal., will build an addition to its machine shop.

The wagon blacksmith shop of Andrew P. Johnson, San Francisco, Cal., was partially destroyed by fire.

The Hewlett Brothers Manufacturing Company, Salt Lake City, Utah, will erect an addition to its can factory.

The Dalton Adding Machine Company, Poplar Bluff, Mo., has increased its capital for the purpose of enlargement.

H. J. Mignerey, Seattle, Wash., will build a new commercial garage and repair shop. Modern equipment will be installed.

The Pacific Electric Heating Company, Ontario, Cal., manufacturers of electrical specialties, will build an addition to its plant.

Joseph Reagan, Los Angeles, Cal., is having plans prepared for a commercial garage and repair shop. The plant will be fully equipped.

The Broderick & Bascom Rope Company, St. Louis, Mo., manufacturing wire rope, is contemplating enlarging its plant and installing modern equipment.

A machine and wood-working shop will be installed in the new Mount Baker High School, to be erected at Seattle, Wash. Edgar Blair, architect, Seattle.

Orange (Cal.) Auto Power Company has purchased the plant of Modern Manufacturing Company and will install machinery to build auto trucks and auto plows.

The West Tacoma (Wash.) Steel Company has been incorporated with a capital of $5,000,000 by W. R. Flaskett and M. E. Gunston. A steel plant is planned on Chambers creek.

The Santa Fe Railroad is having plans prepared for new repair shops and roundhouse to be erected at Calwa and Riverbank, Cal. Estimated cost of plant, $1,000,000.

The Rockwood Auto Company, Spokane, Wash., will build a new commercial garage and repair plant. About $50,000 will be expended. W. H. Dressel is head of this company.

The Northern Pacific Railroad has commenced construction of its new shop buildings at Seattle, Wash. The plant will include machine shops and roundhouse and is estimated to cost $200,000.

Ralph C. Hamlin, Los Angeles, Cal., representing the Franklin automobile, has purchased a site and will build a large commercial garage and repair plant. A complete line of machinery will be installed.

The Barr Brothers-Rogers Company, Eugene, Ore., has acquired property at Oakland, Cal., and will establish a plant for the manufacture of steel tools and cutlery; a plating department will be installed. William R. Barr is president of this company.

CANADA

The Arts Metal Company, of Toronto, will equip a new factory there.

The Westport Foundry Company, of Westport, Ont., will build a new plant.

The Sweet Machinery and Foundry Company will locate a new plant at Cobalt, Ont.

Tre Canadian Rand Company, of Montreal, manufacturing mining machinery, will build a big addition to its plant.

T. S. Simm & Co. are building a big addition to their factory at St. John, N. B., including power house, boiler house and machine shops.

The McKinnon Holmes Manufacturing Company is building a big addition to its plant at Sherbrooke, Que. The concern manufactures structural steel.

GENERAL MANUFACTURING

NEW ENGLAND

Holden, Mass., will extend its water system.

Newburyport, Mass., will extend its sewer system.

Hartford, Conn., will build new engine house on Market street.

The United States Government will install boilers at Keene, N. H.

Bridgeport, Conn., contemplates building a municipal electric-light plant.

Alden Spear Company, of Cambridge, Mass., will erect new printing plant.

The Fall River (Mass.) Electric Light Company will enlarge its plant.

Joseph Bounett will open a lace factory on Jeffers street, Woonsocket, R. I.

West Newbury, Mass., contemplates installing a municipal electric-light plant.

The Meriden (Conn.) Industrial Building Company will build new power plant.

The Easthampton (Mass.) Gas Company will make improvement in its plant.

Fitz Brothers Company, of Auburn, Me., will build an addition to its last factory.

The York Light and Heat Company, of Biddeford, Me., will install new equipment.

Westfield, Mass., has voted $25,000 bonds to enlarge its gas and electric-light plant.

The McEwen Rope Works, New Bedford, Mass., was destroyed by fire. Loss, $5000.

The American Thread Company, Augusta, Me., is to erect an addition to present plant.

Emery & Marshall Company, of Haverhill, Mass., will build an addition to its shoe factory.

The Kroeger Piano Company, of Stamford, Conn., will add new factory building to its plant.

The Hamilton Woolen Company, of Southbridge, Mass., will build an addition to its factory.

Permit has been granted to J. S. Bennett, New Britain, Conn., to erect new laundry, to cost $25,000.

The Norwood Press Company, of Norwood, Mass., will build an addition to its printing plant.

F. A. Goddard & Co., of Lynn, Mass., will build a new factory. The concern manufactures counters.

J. D. Clarke & Co., Rochdale, Mass., will erect new dye house to replace one recently destroyed by fire.

The New Haven Pulp and Board Company (Conn.) is to build a four-story addition to its plant.

The Phillips Electric Light and Power Company, of Phillips, Me., will make improvements at its plant.

The State of Massachusetts has voted $87,000 for a new heating plant for the Lyman School for Boys, Westboro, Mass.

The Hartman Brewing Company, Bridgeport, Conn., is about to build a large addition to its Hamilton Street plant.

C. P. Henry Novelty Company, of Providence, R. I., manufacturing curtain rods, etc., will build an addition to its factory.

H. C. Atwood has purchased factory in Danielson, Conn., which will be equipped immediately for the manufacture of buff wheels.

Mercy Hospital Corporation, Springfield, Mass., has received a permit for the erection of a heating plant and laundry to cost $16,000.

The American Wringer Company, Woonsocket, R. I., is erecting new buildings to be used for the manufacture of mechanical rubber goods.

The Pairprout Corporation, Fall River, Mass., makers of cut glass and jewelry, are to replace the present plant by a four-story structure.

Bowler Brothers, Limited Corporation, Worcester, Mass., intends to build a large addition to its bottling department which will double the capacity.

H. J. Geer & H. J. Geer, Jr., have purchased a plant at Malden, Mass., where they will engage in the manufacture of leather goods and novelties.

Springfield, Mass., is contemplating the installation of a new heating plant, laundry and refrigerating plant in the almshouse and tuberculosis hospital.

The Fall River (Mass.) Webbing Company has been organized with $40,000 to manufacture tapes, braids, etc. A factory has been purchased which will be doubled in capacity. J. E. Estes is president.

The Connecticut Rubber Company, Bridgeport, Conn., has been incorporated with $250,000 capital to manufacture rubber goods and substitutes. Incorporators, Wm. J. Burns, L. F. Nutting, Wm. L. McEwen.

MIDDLE STATES

The city of Portsmouth, O., will install a large waterworks plant.

Fire destroyed the sawmill of Crawford & Son, at Cedar River, Mich.

Fire destroyed the plant of the Canton Fertilizer Company, Canton, O.

The Suwanee Lumber Company, Dowling Park, Fla., will build a sawmill.

Leo Fronek, 3447 East Fifty-second place, Cleveland, O., will erect a box factory.

The Buckeye Rubber Company, Akron, O., will add a five-story addition to factory.

The Harmony iMils, Cohoes, N. Y., has started work on new electric-power plant.

The Advance Paper Company, Amanda, O., is building an extension to its paper mill.

The Neuweiler Brewing Company, Allentown, Penn., is erecting a new power house.

The Dayton (O.) Power and Light Company, will construct new electrical plant soon.

Rawleigh Medical Company, of Chester, Penn., will erect a $50,000 addition to its plant.

Earl Cuykendall's sawmill and stave factory, at Moravia, N. Y., burned. Loss about $8000.

Fire destroyed the elevator of the Columbia Elevator Company, Oakland City, Ind. Loss, $10,000.

The plant of the Canton (O.) Fertilizing Company, was entirely destroyed by fire. Loss, $75,000.

The planing mill of Schmitd-Sisman Company, Detroit, recently destroyed by fire, will be rebuilt.

The K. W. Ignition Company, of Cleveland, O., has taken out a permit for a manufacturing building.

The Prairie State Incubator Company has commenced erection of its $65,000 plant at Homer City, Penn.

The Metropolitan Electric Company, of Reading, Penn., is rebuilding its plant at Kalpperthal, Penn.

W. J. Grandin, Tidioute, Penn., will build new saw and planing mills for large timber tract recently acquired.

The Brockport-Halley Water Company, Brockport, N. Y., will make $15,000 improvements to its two plants.

The National Silk Dyeing Company is making new additions to the power plant, at the Allentown, Penn., works.

The Appleby Lumber Company, Jamestown, N. Y., is building an addition to its plant to be used as a planing mill.

The Jasonville (Ind.) waterworks plant is to be enlarged and new wells are being sunk northeast of the city.

The Appalachian Power Company, Toccoa, Ga., has incorporated with $250,000 capital. Will erect a water power plant.

The Port Huron Paper Company, of Port Huron, Mich., has been incorporated and will soon start active operations.

Fire practically destroyed the plant of the Albany (N. Y.) Chemical Works, on Van Rensselaer Island. Loss, $100,000.

The Pfister & Vogel Company, Milwaukee, Wis., has let contract for three-story addition to tannery on Oregon street.

The cooperage plant of the R. G. Peters Salt and Lumber Company, East Lake, Mich., was destroyed by fire. Loss, $20,000.

The plant of the American Window Glass Company, at Hartford City, Ind., was damaged by fire to the extent of $15,000.

The Dent Hardware Company, at Fullerton, Penn., is building a new power house. Will gradually electrify its entire plant.

The American Locomotive Company has let contract for the erection of a new wheel plant for the Brooks plant at Dunkirk, N. Y.

The Hercules Paving Company, of Philadelphia, is having a boiler house erected at Ring street and Schuylkill river, Philadelphia, Penn.

The Union Laundry Company, Indianapolis, Ind., will erect at once a laundry building at Lexington avenue and Pine street, to cost above $15,000.

Contracts have been awarded for a two-story concrete factory for the Organic Chemical Company, to be erected at Fort Washington, Philadelphia, Penn.

Kankakee (Ill.) Elevator Company, incorporated with $10,000 capital by Henry J. Patten, Herbert E. Rycroft and William E. Hudson to build grain elevator.

The Upland Flint Bottle Company, Upland, Ind., has been incorporated with a capital of $50,000 by A. M. Foster, W. C. Forbes and S. L. Petterson to manufacture bottles.

The Distilled Water Ice Company, Youngstown, O., has been organized with $10,000 capital to manufacture ice by W. H. Winsworth, H. A. McIntosh, Frank L. Baldwin, etc.

The Frazee Sterling Laundry Company, of Cleveland, O, has been incorporated to do a general laundry business by John N. Frazee, Henry Frazee, G. E. Frazee, etc. Capital, $30,000.

The Department of Public Works, of Buffalo, N. Y., will receive bids until July 1 for furnishing and erecting a power-plant equipment at the Adam Mermorial Hospital, at Perrysburg, N. Y.

The Sidney Ice and Storage Company, Sidney, O., has been organized with a capital of $25,000, to manufacture ice. Incorporators, H. E. Bennett, W. B. Taylor, E. W. Bringham, etc.

Manufacturers Rubber and Supply Company, Akron, O., has been incorporated to manufacture all kinds of rubber articles by R. F. Dutt, R. F. Griffiths, William F. Pfeiffer, Frank C. Milhoff, etc.

Chicago (Ill.) Motion Picture Machine Company, has been incorporated with $25,000 capital to manufacture motion-picture machines and accessories by Rupert G. Stronach, C. E. Robinson, U. G. Ward.

The Independent Ice Company, South Bend, Ind., has been organized with $20,000 capital, to engage in the manufacture of artificial ice in that city. Directors, D. P. Clem, G. D. Staples, W. M. Hildebrand.

The city council of Washington, Ind., has granted a franchise to the Vincennes, Washington and Eastern Traction Company, which proposes to construct an electric railway from Vincennes, Ind., to Loogootee, Ind.

The Hamilton Railway has been formed to construct a railroad from Hamilton, Ill., to Keokuk, Ia. Principal offices, Chicago. Directors, George Higginson, Jr., Winnetka, Ill.; Joseph D. Harvey, Geneva, Ill.; etc.

The Bank Furniture Company, Indianapolis, Ind., will erect a three-story factory building at Sixteenth and Lewis streets. The company will manufacture high-grade bank and office furniture. Louis H. Levey is president of the company.

The Frankfort, Kokomo & Western Traction Company, Kokomo, Ind., has been incorporated with $10,000 capital by George J. Marrott, Indianapolis; Thomas C. McReynolds, Kokomo; John B. Carter, Kokomo, and others. To build an electric railway between Frankfort, Ind., and Kokomo, Ind.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids July 18, for leather belting (schedule 3709), lifting blocks, twist drills, hinges, locks, reamers, scales, wood screws, machinists' vises, pipe vises, pipe wrenches, screw wrenches (schedule 3708), sheet brass, copper rod and bar copper (schedule 3712), angle, bar, forging steel (schedule 3711).

SOUTHERN STATES

The Parkersburg (W. Va.) Mill Company will rebuild sawmill recently burned.

Greenville, Tenn., will issue $65,000 bonds for municipal electric-light plant and water works.

The Desnoyers Shoe Company, St. Louis, Mo., it is said has plans for a large new factory.

Sawmill, planing mill, etc., of the Lee Lumber Company, Tioga, La., were destroyed by fire. Loss, $75,000.

The American Net and Twine Company, Anniston, Ala., has prepared plans for an addition to its plant.

The seven-story plant of the Jack Daniel Distilling Company, of St. Louis, Mo., was destroyed by fire. Loss, $100,000.

Fire in St. Louis, Mo., destroyed the plants of the Hutting Sash and Door Company, Missouri Stair Company, Mound City Box Company, Koken Iron Works, planing mill of Fathmere & Miller, entailing a loss of about $1,000,000.

WEST OF THE MISSISSIPPI

The Henley Packing House (fruit), Globe, Cal., was destroyed by fire.

The Pomona (Cal.) Cannery (fruit) will build an addition to its plant.

The Granite Falls (Wash.) Laundry Company's plant was destroyed by fire.

The lumber mill of the Bridgeport (Wash.) Milling Company was destroyed by fire.

The Valley Water Company, LaCanada, Cal., will install a waterworks system.

The city of Merrill, Ore., is planning for the installation of a waterworks system.

The Belmont Bracket factory, Portaind, Ore., will build an addition to its plant.

The Wynochie Shingle Mill, Montesano, Wash., was destroyed by fire. Loss, $50,000.

George Gillett, Richland, Ore., is planning to install a pumping plant on the snake river.

The Bakersfield (Cal.) Ice Delivery Company will build a new cold-storage plant at Taft, Cal.

The Arizona Portland Cement Company, Phoenix, Ariz., will build a cement plant near Tempe, Ariz.

George Noble Todd, Tombstone, Ariz., is planning for the erection of a hydroelectric plant in this section.

The Globe Grain and Milling Company, San Francisco, Cal., plans to increase the capacity of its plant.

The city of Oakland, Ore., has voted bonds for $15,000 for the installation of a new light and power plant.

Loges & Vore, operating the Reedley (Cal.) laundry, are planning for the erection of a new plant at Dinuba, Cal.

The Jotham Bixby Company, Los Angeles, Cal., has taken out a permit to build an addition to its cold-storage plant.

The W. P. Hammon Company, San Francisco, Cal., is planning for the erection of a power plant at Lake Tahoe, Cal.

George H. Downing, Whittier, Cal., is planning for the erection of a new laundry plant. Modern machinery will be installed.

The city of North Yakima, Wash., will vote on a bond issue of $300,000 for the installation of a municipal power plant.

The city of Santa Barbara, Cal., has issued bonds for $40,000 for extensions and improvements in its waterworks system.

The State Normal College, Dillon, Mont., will build a new boiler house, and install new equipment. Dr. H. H. Swain is in charge.

F. T. Russell, Oakland, Cal., is planning for the erection of a paper-mill plant, of 30 tons daily capacity, at Klamath Falls, Ore.

N. A. Walcott, Los Angeles, Cal., has taken out a permit to build a new printing plant. Modern equipment will be installed.

The G. M. Curtis Olive Company, Bloomington, Cal., will build an addition to its packing house. Modern machinery will be installed.

The Pacific Light and Power Company, Los Angeles, Cal., is planning for the erection of a new power plant on Big creek in Fresno county.

The Northern California Power Company, Sacramento, Cal., will increase the capacity of its power plant at Kilarc from 5000 horsepower to 8000.

The Hydro Electrical Company, Hood River, Ore., recently incorporated with a capital of $250,000, is planning for extensive operations in this vicinity.

J. P. Weaver and E. G. Anderson, Portland, Ore., have purchased the Dalles (Ore.) Brick plant. The capacity will be increased and new machinery installed.

The Board of Supervisors, Los Angeles, Cal., will call for new bids on generating equipment for the Hall of Records. Former bids have been turned down.

F. J. Wood, of the E. K. Wood Lumber Company, Bellingham, Wash., has acquired property at Anacortes, Wash., and contemplates the erection of a new mill.

The Sierra & San Francisco Power Company, San Francisco, Cal., has issued bonds for $1,000,000, to be used for power-plant construction on the Stanislaus river.

The California Alfalfa Meal Milling Company, Los Angeles, Cal., is planning to build new milling plants at Bishop and near Laws, Cal. Modern machinery will be installed.

J. L. Robinson, Willows, Cal., is planning for the erection of a fruit- and vegetable-canning plant. Modern machinery will be installed. C. L. Donohoe is also interested.

The Washington Water Power Company, Spokane, Wash., is planning to develop its power site at Long Lake; new equipment will be installed to complete its plant at Little Falls.

The Northwestern Electric Company, Goldendale, Wash., is planning for the erection of a new power plant on the Klickitat river. The initial capacity will be about 5000 horsepower.

The city of Redmond, Ore., has perfected plans for the installation of a waterworks system. Pumping machinery will be installed at Cline Falls. Estimated cost of work, $25,000.

The W. P. Fuller Company, Los Angeles, Cal., has acquired the plant of the Pacific Window Glass Company, Stockton, Cal. The plant will be improved and new equipment installed.

M. R. Madary and J. G. Simpson, Fresno, Cal., are planning for the erection of a large sawmill plant at Sammy Merrill Springs, Cal. The initial capacity will be about 60,000 feet daily.

Power-plant equipment will be required for the new seven-story hotel to be erected at San Francisco, Cal. Estimated cost, $140,000. O'Brien Brothers, architects, San Francisco, are preparing plans.

Power-plant equipment will be required for the new five-story building to be erected by the Berkeley (Cal.) Elks' Hall Association. Estimated cost, $150,000. Shea & Lofquist, architects, San Francisco.

The Orient & Occident Lumber Company has acquired the plant of the Nelson-Johansen Lumber Company, Tacoma, Wash. The new owners will make extensive improvements and install new equipment.

Power-plant equipment will be required in the new six-story hotel building to be erected by the Smith Hotel Company, Portland, Ore. Estimated cost, $115,000. A. F. and Hedwig Smith are interested in this company.

The El Dorado Coöperative Creamery Association, has been organized at Diamond Springs, Cal. The company will build a modern creamery plant and will fully equip. C. H. Schroeder is head of this organization.

The Cerritos Sugar Company, Los Angeles, Cal., recently incorporated with a capital of $750,000, is planning for the erection of a sugar factory in this section. Carroll Allen, Los Angeles, is interested in this company.

The Shade-Fowler Manufacturing Development Company, San Antonio, Tex., has been organized with $500,000 capital to manufacture an automobile wheel invented by Theodore Shade. J. O. Howard is president.

The Artificial Ice Skating Rink Company, Salt Lake City, has been incorporated with a capital stock of $80,000. The company will build a plant for ice manufacture for commercial use of 50 tons daily capacity; an ice-skating rink will also be maintained. J. W. Mellon is head of this company.

CANADA

The Elora Furniture Company, of Elora, Ont., will double its factory.

Oshawa, Ont., will install a complete new plant for sewage disposal.

The Dominion Explosives Company will equip a new $100,000 plant at Ottawa, Ont.

The William Gray Carriage Company, of Chatham, is building a big addition to its factory.

The Montreal Terra Cotta Lumber Company will equip a new $150,000 plant at Montreal.

The St. Marys Portland Cement Company will equip a $500,000 plant at St. Marys, Ont., immediately.

Southampton, Ont., will buy a new turbine pump and electrical equipment for extensions to waterworks system.

It is reported that the J. C. Wilson Paper Company, Montreal, Can., will erect a new building on St. Alexander street.

O. B. McCallum, of Montreal, is head of the Prince Rupert Hydro Electric Company which will develop power there.

Forty thousand dollars worth of machinery destroyed by fire in the Dominion Sawmill, at Revelstoke, will be replaced at once.

New Glasgow, N. S., will spend $200,000 for improvements to its waterworks system, including new pump house and machinery.

The Wayagamack Pulp and Paper Company is building an immense new plant at Three Rivers and much new machinery will be purchased.

MINING

The Independence mine, near Alleghany, Cal., will install a 5-stamp mill.

Charles Gagner, Durango, Colo., contemplates the erection of a steamp mill.

The White Elephant mines, near Yuma, Ariz., contemplates the erection of a milling plant.

The Paradise (Ariz.) Mining and Milling Company will build a new concentrating plant.

The San Juan Reduction Company, San Antonio district, Lower California, will build a cyanide plant.

The Hewitt Brothers, operating at Hopkins Creek, Plumas county, Cal., will install a 5-stamp mill.

The Las Adargas mine, Jimenez, Chihuahua, Mex., is contemplating the erection of a smelting plant.

The American Exploration and Mining Company, Steeplerock, N. M., will build a 50-ton milling plant.

The Helen-Esther Mining Company, near Dutch Flat, Cal., will increase the capacity of its stamp mill.

The Mill Mountain Mining Company, Conconully, Wash., is planning for the erection of a new stamp mill.

The Sink to Sink mines, Copper Basin district, near Prescott, Ariz., is planning to erect a reduction plant.

The Magma mine, near Superior, Ariz., plans to install a plant for low-grade ore treatment in the near future.

The Ohio Keating Mining Company, Radersburg district, Mont., is planning for the erection of a concentrating plant.

The Trinidad Mines Company, San Antonio district, Lower California, is planning for the erection of a cyanide plant.

The Bully Hill Mining and Smelting Company, Delamar, Cal., is contemplating the erection of a zinc-smelting plant.

The Chileno mine, Tuttletown district, Tuolumne county, Cal., is contemplating the installation of new milling equipment.

The Alaska mine, near Congress, Ariz., is contemplating the installation of a stamp mill. D. J. Sullivan is head of this property.

J. M. O'Brien, San Francisco, Cal., has bonded the Tightner mine, near Alleghany, Cal., and contemplates the erection of a 10-stamp mill.

The Kidd mines on Nimshew ridge, Butte county, Cal., contemplate the erection of a stamp mill. R. P. Holmes, Chico, Cal., is interested in this property.

TRADE CATALOGS

Hill Publishing Company, Ltd., 6-8 Bouverie street, Fleet street, London, E. C. Catalog. Mechanical and technical books.

Boston Gear Works, Norfolk Downs, Mass. Catalog E-4. Gears, sprockets, chains, ball bearings, etc. Illustrated, 80 pages, 3½x6 inches.

The Bullard Machine Tool Company, Bridgeport, Conn. Circular MM-164. "Maxi-Mill" vertical boring and turning mill. Illustrated.

The Linde Air Products Company, 155-183 Chandler street, Buffalo, N. Y. Catalog. Oxy-acetylene welding apparatus. Illustrated, 50 pages, 6x9 inches.

Eadie-Douglas, Ltd., 12-14 University street, Montreal, Canada. Condensed catalog of building, mechanical, steam supplies. Illustrated, 16 pages, 4x8 inches.

Armstrong Brothers Tool Company, 339-357 North Francisco avenue, Chicago, Ill. Booklet No. 5. Drop-forged lathe dogs and clamps. Illustrated, 8 pages, 3½x6 inches.

Westinghouse Electric and Manufacturing Company, East Pittsburg, Penn. Circular No. 1194. Engine driven direct-current interpole generators. Type Q. Illustrated, 12 pages, 7x10 inches.

The Bristol Company, Waterbury, Conn. Bulletin No. 131. Recording voltmeters for direct and alternating current. Illustrated, 44 pages, 8x10½ inches. Bulletin No. 147-A. Bristol-Durand radii averaging instrument for circular chart records. Illustrated, 8 pages, 8x10½ inches.

FORTHCOMING MEETINGS

Society for the Promotion of Engineering Education, annual convention, June 27-29, Pittsburg, Penn. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

American Society for Testing Materials, annual meeting, June 27-30, Atlantic City, N. J. Edgar Warburg, secretary, University of Pennsylvania, Philadelphia, Penn.

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. M. W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Automatic and light machinery, tools, dies, jigs and fixtures designed. B. Nash, 257 Martense St., Brooklyn, N. Y.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Working drawings made from sketches or specifications; detailing and designing done; sheet metal layouts made; rates reasonable. Box 26, AMERICAN MACHINIST.

Competent mechanical engineer, N. Y. City, designs special and automatic machines and tools for all kinds of duplicate work; highest references. Box 852, AMER. MACH.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

An incorporated company, with plant in New Jersey, manufacturing small forged tools, is desirous of increasing their line and would consider consolidating with some other small company or firm making a different line of tools, or adding other lines of tools. Box 14, AMERICAN MACHINIST.

Castings, machine work; a contracting engineering firm, with an established business, is desirous of getting in touch with a shop in or near New York City, which is in a position to take on work, consisting of castings rough and machined, composing parts of water softeners; would prefer concern having a tank shop in connection or in immediate vicinity. Box 15, AMERICAN MACHINIST.

We will shortly be ready to place contracts for a large number of machines, weighing about 1000 pounds and requiring a good grade of work, about like machine tools; we desire to correspond with parties having modern equipment, who are in position to handle this work to advantage and are able to turn out high grade work at a fair price; we prefer to place the business with parties who are prepared to take care of our requirements for a considerable time; the product will stand a fair shop profit and if we can get the right kind of work and get it continuously, we are willing to pay a fair price; if interested, please state size of plant, number of men which can be employed on our work, and foundry facilities. Box 973, AMER. MACH.

A large and well known firm in central New England, which has been engaged in the manufacture of special machinery for upwards of forty years, is desirous of taking on some outside lines, its own legitimate line of manufacture being suffering from a depression in business, and in order to keep as many of its employees busy, and its organization as intact as possible during the dull period, we wish to make connections for taking on outside lines of machine work; our plant is a very complete and modern one; our machine tool equipment represents an investment of about $125,000; we have a full line of gear cutters, automatic screw machines, and Jones & Lamson turret lathes, etc.; our capital is ample, and we guarantee to handle in a satisfactory manner any work that may be intrusted to us. Write us your requirements. Address Box 72, Worcester, Mass.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—Experienced hydraulic engineer to take charge of sales of water wheel installations; state experience. Apply to William Hamilton Company, Ltd., Peterborough, Ont.

Wanted—Mechanical partner with eight to ten thousand dollars capital in growing business in Canada; no encumbrance; must possess thorough knowledge of jig designing; to produce small interchangeable parts requiring rapid and accurate assembling; also gear cutting and building of marine motors. Address P. O. Box No. 682, Montreal, Canada.

CONNECTICUT

A development laboratory wants electrical mechanic and machinist on model work; one with fair drafting ability and some technical knowledge preferred; state full particulars and pay expected to "S. L.," P. O. Box 232, Hartford, Conn.

ILLINOIS

Wanted—First-class machinist and toolmaker to take charge of tool room and machine repairs in machine shop employing about one hundred and fifty men; no jig designing required, but must be energetic, systematic and capable of handling eight to ten men efficiently. Address "Gas Engines," AMERICAN MACHINIST.

Wanted—General manager for well-established factory of 300 men manufacturing special heavy machinery in large city of middle West; must have a high grade of organizing and executive ability as proved by successful experience in increasing factory output on a large scale, familiarity with modern methods of management, and the requisite mechanical knowledge; state fully all particulars of experience and qualifications, together with salary required; all answers strictly confidential. Box 18, AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—Grinding machine salesman; the right man can make good connections with a responsible concern. Box 24, AMER. MACH.

Wanted—Draftsman who has had experience in designing grinding machines; a permanent position with good pay awaits the right man. Box 25, AMERICAN MACHINIST.

Wanted—First class car draftsmen, those familiar with wood and steel car experience preferred; none but first class men need apply. Osgood Bradley Car Company, Worcester, Mass.

Wanted—Man to take charge of shipping and cleaning room in iron foundry; must be experienced and have good executive ability; good position for the right man. Box 983, AMERICAN MACHINIST.

Draftsman wanted by a large pump manufacturer, a first-class man capable of working up new designs from rough sketches or verbal directions; must be a man with original ideas and initiative; for such a man we have a good opening where future advancement will be governed wholly by his abilities; give complete outline of experience, education, references, salary expected, etc. Box 4, AM, MA.

Wanted—General superintendent for a large and successful manufacturing concern employing high grade skilled labor; applicant must be man of first class mechanical ability and familiar with modern production methods, having a large and successful experience in handling help; he must also be capable of organizing various mechanical departments and be proficient in obtaining the fullest efficiency of same. Box 17, AMER. MACH.

Wanted—Competent foreman for automatic screw machines and turret lathes; must have broad experience in small-sized accurate work, familiar with setting up work, able to design his own tools; give names of machines experienced in; only men with wide experience need apply; give detailed experience, places and periods of employment, references, age and salary expected. Address "Foreman," Box 1574, Springfield, Mass.

Wanted—First-class tool designer to take charge of tool drafting room of manufacturing company; must be experienced and

competent in design of jigs, fixtures, punches, dies and other special tools used for quantity production of light machine parts on an interchangeable basis; give technical education, detailed shop and office experience, places and periods of employment, references, age and salary expected. Address "Designer," Box B, Springfield, Mass.

NEW JERSEY

Openings for first-class all-around machinists; men used to automobile manufacturing; steady employment with good wages for efficient men. Box 924, AMERICAN MACHINIST.

Draftsmen—Competent men with broad experience in mill building construction, power plant design and general engineering wanted at once by large industrial plant near New York City; full particulars as to experience, age, salary and references wanted. Box 991, AMERICAN MACHINIST.

Wanted—A first class metal pattern maker, experienced in making patterns for ornamental castings; must also be familiar with plate and vibrator frame work for Tabor machine; applicants must give full advice as to nature and extent of experience and wages expected. Box 986, AMERICAN MACHINIST.

Wanted—Department foreman, a man to take full charge of 50 to 75 men; must be thoroughly familiar with modern methods and have ability to handle men to the best advantage and produce results; good position for the right man; reference required. Address, stating full particulars, Box 2, AM. M.

NEW YORK

Wanted—First class machinists, familiar with marine work, tool hands and outside men only; good wages. Box 3, AM. MACH.

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 984, AMERICAN MACHINIST.

Wanted—Two first class operators of horizontal boring machines; state age, experience and references; applications considered confidential. Box 23, AMERICAN MACHINIST.

Foreman for machine shop, experienced in modern methods and in building internal-combustion engines; give references, salary and experience last five years; northern New York. Box 34, AMERICAN MACHINIST.

Wanted—Draftsman, experienced in valves or pumps preferred; in replying, state experience in detail, age, wages expected, if now employed, married or single; permanent position for right man. Box 11, AM. MACH.

Wanted—Machinists wanted. lathe hands, screw machine hands, etc.; steady position, desirable surroundings, good wages, no labor trouble. Apply by letter, giving account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Wanted—First class tool and die makers, drop-forge die sinkers, Fox lathe hands; steady position, good wages, no labor trouble; apply by letter, giving detailed account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Wanted—Works manager for factory employing two hundred machinists and molders; must have technical education, shop practice and proved executive ability; state terms, experience and reference; location, central New York. "R. F. S.," AMERICAN MACHINIST.

Salesman for line of pliers and some high grade specialties to visit jobbing and retail trade east and west; must also visit machine shops to introduce specialties; state age, experience, territory covered, salary desired and references. "K. F.," AMERICAN MACHINIST.

Wanted for a large factory, employing about 3000 men, an experienced general manager; must have a thorough mechanical training, together with business experience; some one now occupying such a position and looking for greater opportunity might find it to his advantage to communicate with Box 5, AMERICAN MACHINIST.

OHIO

Wanted—A first class mechanical engineer; one experienced in designing commercial wagons and trucks. Box 12, AMER. MACHINIST.

Wanted—For Chicago territory an experienced crane salesman; man with mechanical engineering experience preferred. Box 30, AMERICAN MACHINIST.

Wanted—An office manager with practical experience in mechanical lines and is able to invest $5000 for ¼ interest, in manufacturing a machine that has no competition and is an immense seller. Box 35, AMERICAN MACHINIST.

Designer for metal specialties and machine tools; one who can originate rather than copy; exceptional opportunity with long established concern in Middle West; give full experience and salary last received. Box 10, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Machinists Wanted—First class lathe, planer, boring mill and bench hands. Address Mr. Wm. J. Casey, Shop Superintendent, The Jeanesville Iron Works Co., Hazleton, Pa.

Wanted—Foreman, about 35 years for plating plant; must be thorough in all its branches and handle help properly; give references, experience and salary expected. Address "L. M. F.," AMERICAN MACHINIST.

Wanted—Assistant foreman, about 35 years, for punch press and hydraulic work on sheet metal; must be good mechanic and handle help properly; give references, experience and salary expected. "B. K. T.," AMER. MACH.

Wanted—Foreman, about 35 years for department manufacturing and assembling small interchangeable parts; must be good mechanic and handle help properly; give references, experience and salary expected. "J. B.," AM. M.

Wanted — One quarterman shipfitter-in-charge at $5.04 per diem; a competitive examination will be held July 17, 1911, for the purpose of filling the above position. For further information address "Commandant, Navy Yard, Philadelphia, Pa."

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—50 tool makers; experienced men on jigs, fixtures, punches and dies and other special tools used in the manufacture of high grade machine parts on an interchangeable basis; apply by letter, stating age, experience and salary required, as well as the date when you would be able to start if application was accepted. The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Mechanic, age 32, technically educated, of proven ability and integrity desires responsible position; has 10 years' experience in fine tool and experimental work; A-1 references, expectations moderate. Address P. O. Box 381, West Hartford, Conn.

ILLINOIS

Wanted—Position as assistant superintendent or foreman; have had 11 years' experience as foreman and superintendent, designer; expert in jig making; 40 years old, married, of temperate habits. Box 31, AMER. MACH.

Position as superintendent, by expert tool designing draftsman, experienced as draftsman, tool and die maker, and tool room foreman on typewriter and similar work; age 32, married. Box 6, AMERICAN MACHINIST.

Mechanical engineer, 32, thoroughly acquainted with modern shop methods, first-class systematizer of drafting offices, and designer of automatic machinery, with long and successful practical and technical experience in conducting experimental work, is open for position in accordance with his qualifications. Address Box 30, AMERICAN MACHINIST, 122 South Michigan Boulevard, Chicago, Ill.

MAINE

Manager or superintendent of machine shop, forge or foundry; first class references. Box 996, AMERICAN MACHINIST.

MASSACHUSETTS

Mechanical engineer, draftsman, designer, college graduate, with nine years' practical shop and office experience on general engineering, desires progressive position; would consider sales department. Box 988, AM. M.

NEW JERSEY

Experienced salesman of machinery and machine supplies. Box 13, AMER. MACHINIST.

Technical graduate (27), German descent, good designer, with broad shop experience, wishes position as foreman, superintendent, assistant or engineer, with manufacturing concern, electrical or mechanical. Box 26, AMERICAN MACHINIST.

NEW YORK

Master mechanic and chief planner desires change; capable man, large job; splendid record. W. J. H., AMER. MACH.

Successful tool room and manufacturing foreman with electrical concern wishes to change; New York or vicinity. Box 29, AM. M.

Designer of crude-oil high-compression reversible engines, open for responsible position of design or construction. Box 999, AM. MA.

Mechanical engineer, technical graduate, eight years' experience, desires a position in or near New York City. Box 949, AM. MACH.

Mechanical superintendent, with 18 years' experience, wishes change; broad experience in factory management; a good executive and organizer; good references. Box 28, AM. MA.

Mechanical expert desires position as superintendent, general foreman, or improving and developing equipment, experienced tools, dies, automatic machinery. Box 32, AMER. MACH.

Designer, 31, three years' machine shop, ten years' drawing-office experience, expert on jigs, fixtures, tools and special machinery, at present employed, desires position. Box 22, AMERICAN MACHINIST.

Designing draftsman, technical graduate, general experience and 15 years with air compressor and Corliss engine builders, wants position; best of references, full particulars on request. Box 33, AMER. MACH.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

Salesman, with road experience, wishes to connect with machine tool or manufacturing house; thoroughly practical and could take charge of local sales office or act as purchasing man. Box 19, AMERICAN MACHINIST.

I am technically educated, 38 years old, have excellent record for inventing, developing and organizing the manufacture of duplicate machinery and apparatus; ten years in present position; satisfactory references; salary $3600. Box 992, AMERICAN MACHINIST.

OHIO

Foreman of tool room or general shop foreman, uptodate in modern shop methods and can produce results; good reference; age 38. Box 16, AMERICAN MACHINIST.

Automobile engineer, with eight years' experience in drafting room, shop and experimental room, desires to make a change; recommendations exceptionally good. Box 27, AMERICAN MACHINIST.

Wanted—Position as works manager or superintendent by one experienced in uptodate manufacturing; piece work, premium and standard time systems; 13 years in executive positions, employing large number of men; first class mechanic, organizer and cost reducer; A-1 references; age 36. Box 7, AM. M.

Wanted—Position as manager or general superintendent; thoroughly practical and experienced in the management of manufacturing plants, consisting of main office, machine shop, foundry, blacksmith shop, boiler shop, wood shop and kindred departments; will take charge on salary or commission or both, and with highest degree of productive efficiency and lowest cost of production, guarantee freedom from labor troubles of every description. Box 966, AMERICAN MACHINIST.

A superintendent with 20 years' experience and a factory manager with 15 years' experience, both 35 years old and connected with same company and more than making good, desire a wider field and will make a profitable change; will guarantee to organize and systematize any manufacturing establishment, obtain maximum output at minimum cost; correspondence is invited or a visit to the plant where they are at present employed. Box 925, AMERICAN MACHINIST.

PENNSYLVANIA

First class draftsman with eight years' experience, wants position. Box 8, AM. MACH.

Designer on special machinery, ready to develop ideas, desires change. Box 9, AM. M.

Pattern shop foreman desires change; eight years' experience as foreman; versed on molding machine work, reputation of reducing pattern cost; references. Box 21, AM. MACH.

FOR SALE

Patent on combined nail puller and hand cutter for sale. Box 952, AMER. MACHINIST.

For Sale—One ¾-inch new model Cleveland automatic screw machine with three spindle speed attachment, tilting magazine and complete set of tools; new machine in perfect condition; has been used not more than 700 hours; not adapted to our work. Box 956, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

One morning a few years ago a peculiarly interesting story came out in the New York newspapers. It stated that the town of Brownsville, Texas, had involuntarily seceded from the Union—

That during the recent heavy rains the Rio Grande River had swelled, overflowed its banks and pursued a new and original course across the country—

That by this change of route the Rio Grande, instead of flowing in its time-honored bed *south* of Brownsville, now ran in a new course fifteen miles *north* of that growing town—

And that, as the Rio Grande River was the boundary between the United States and Mexico, Brownsville was now thrown south of the river and was, therefore, in Mexico!

After reading this article, the writer, being of a more or less skeptical nature, dropped a line to the postmaster of Brownsville asking him how much truth there was in the startling report.

About three weeks later he received a lengthy, wrathful letter from the Texas P.M. It said, in effect: "There is no truth at all in the story.

"The Rio Grande hasn't changed its course an inch and even if it did this foolish dream couldn't happen—the boundary line is absolutely fixed by the treaty between the United States and Mexico.

"If the Rio Grande turned and ran up to Oregon the boundary would remain unchanged and Brownsville would still be an American town.

"The story was sent out by a promoter who thought any kind of publicity would pay—and nothing has done us more harm than the circulation of this ridiculous report.

"What we want to advertise to prospective settlers from the North is that, by coming to Brownsville, they can become prosperous Americans—not Greasers."

The point at once struck us that it was the promoter, and not the Rio Grande, that had overstepped the boundary.

He was attracting attention to his product, Brownsville, by making false statements about it. He thought he was an advertising man when really he was only a press agent. He told a lie to incite curiosity instead of telling the truth to inspire confidence. His fanciful story had to be authoritatively denied broadcast before the tide of home-seekers again turned toward the Texas town.

That this principle of profitable advertising has become gospel today you can see by reading the ads in your paper.

It would be business suicide for an advertiser in the AMERICAN MACHINIST to print a "Brownsville" story over his name.

The modern manufacturer works on a different method.

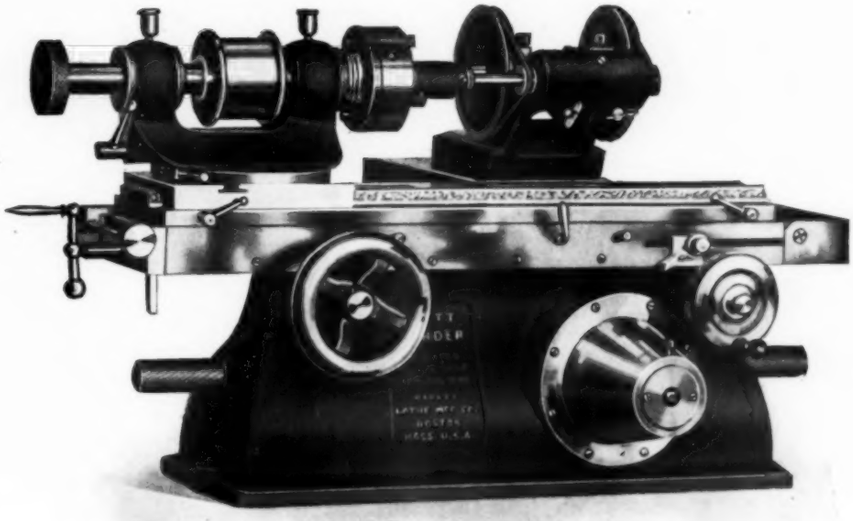
He spends his time, his brains and his money to make his product so good and so reliable that, when it comes to advertising it, the strongest things he can say about it are the true ones.

This is why the advertising pages of your technical paper are so informative.

It's why many a man today reads the advertising section before he does the reading matter.

* * *

Only reliable products can be continuously advertised.



The Rivett Grinder No. 3

Is just the Machine for grinding straight holes up to 2" Diameter and 2" Deep; it is also equipped for Taper Work.

Why spend hours truing up small holes by the old method of lapping them when this Grinder will grind them to a smooth finish in a few minutes, and it does not leave the usual bell mouth.

For work such as Gauges, Automobile Bearings, or any fine work that must be ground accurately, this Machine cannot be beat.

Send for our new catalogue which gives all the details.

The Rivett Lathe Manufacturing Company

Brighton, Boston, Mass.

Rivett Lathes are carried in stock by Hill, Clarke & Co., at New York, Philadelphia and Chicago; Pacific Tool & Supply Co., San Francisco, Cal., and by Motch & Merryweather Machinery Co., at Cleveland

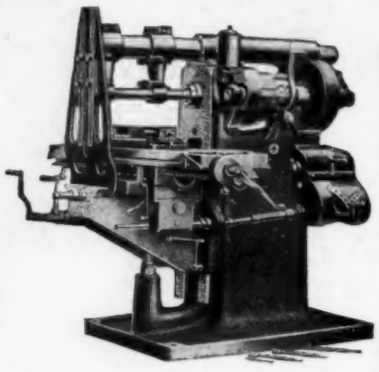
No cutters have a higher reputation for accuracy than

B. & S. Cutters.

They are regularly carried in stock in 36 styles and 3700 sizes.

For further particulars see page 57.

B·S Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.



LE BLOND

MILLERS

Eight Sizes of Plain.
Six Sizes of Universal.

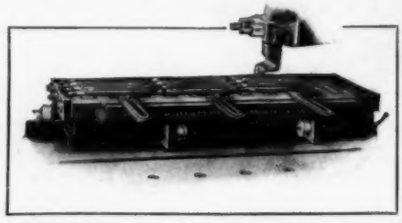
Send for Catalog

The R. K. LeBlond Machine Tool Co.,
Cincinnati, Ohio.

The Wm. H. Bristol Electric Pyrometers

Write for 56 page illustrated catalog of the Wm. H. Bristol Electric Pyrometers giving a partial list of users including the names of more than 120 concerns using these Pyrometers in connection with Hardening and Annealing Furnaces.

The Bristol Company, Waterbury, Conn.

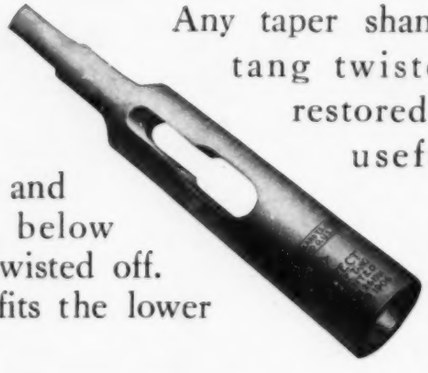


WANT to hold your flat-sided iron and steel work on planers or surface grinders, without using bolts, straps or jaws? Then use WALKER MAGNETIC CHUCKS. They are made in 30 styles and sizes—over 3000 now in successful use. Chucks also furnished for revolving work.

Ask for details and prices.

O. S. Walker & Co., Worcester, Mass., U.S.A.

From The Scrap Heap To The Drill Press



Three Minutes' Grinding

puts on a new and stronger tang below the one that's twisted off. The new tang fits the lower slot in

Any taper shank drill with its tang twisted off can be restored to its original usefulness, easier and quicker than you can grind its point when dull.

The "PERFECT Double Tang" SOCKET

fits any spindle having a regular taper hole

Ask your dealer *Write for Folder No. 2-A*

The CLEVELAND Twist Drill Co.

New York Cleveland, Ohio Chicago